A REVISION OF SELECTED CLADES OF NEOTROPICAL MITE HARVESTMEN (ARACHNIDA, OPILIONES, CYPHOPHTHALMI, NEOGOVEIDAE) WITH THE DESCRIPTION OF EIGHT NEW SPECIES

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Abstract. Among the least-studied families of mite harvestmen (Opiliones, Cyphophthalmi) is the family Neogoveidae, a group of arachnids that inhabits tropical rain forests on both sides of the Atlantic Ocean around the Equator, and an exquisite example of Gondwanan vicariance. To evaluate the diversity within Neogoveidae we studied the morphology of all currently recognized genera using a recent phylogeny of the group to provide a framework for the family in the Neotropics. That study identifies several clades that correspond to the recognized genera *Neogovea*, *Huitaca*, *Metagovea*, *Canga*, and the recently resurrected genus *Brasilogovea*, formerly synonymized with *Neogovea*. *Neogovea* is restricted to eastern Amazonia (Brazil, Guyana, French Guiana, Suriname), *Huitaca* remains endemic to Colombia, *Canga* is restricted to its type locality in the Serra de Carajás (Pará State, Brazil), *Brasilogovea* to Central Amazonas and the Tepuis region in Colombia, and *Metagovea* is the most widespread genus, found along the northern Andes from Perú to Venezuela, and extending to the Amazon region. All Neotropical genera are diagnosed and discussed. The formerly monotypic *Huitaca* is revised with the description of six additional species, all found in the high-altitude Colombian mountain areas called cordilleras, between 2,030 and 3,050 m. These include: *Huitaca bitaco* **new species**, *Huitaca boyacaensis* new species, *Huitaca caldas* **new species**, *Huitaca depressa* new species, *Huitaca sharkeyi* new species, and *Huitaca tama* new species, all from Colombia. Two additional species, *Brasilogovea chiribiqueta* new species, from Colombia, and *Neogovea hormigai* new species, from Guyana, are also described.

Key words: Neotropics, Phylogeny, Biogeography, Taxonomy, New Species, Gondwana, *Huitaca*, *Neogovea*, *Brasilogovea*

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INTRODUCTION

The suborder Cyphophthalmi contains small Opiliones that inhabit the soil of pristine temperate or tropical forests around the world (Juberthie, 1988), although a few species live in caves (e.g., Rambla and Juberthie, 1994; Schwendinger and Giribet, 2005). They differ from the other three suborders of Opiliones in their mite-like aspect and in the position of the ozopores, which are located at the tip of a cone-like structure named ozophore. Within the suborder, the family Neogoveidae is distributed in tropical South America, tropical West Africa, and the Southeast United States, and is currently composed of seven genera: *Metasiro* Juberthie, 1960 from the Southeast United States; *Parogovia* Hansen, 1921 from West Africa; and five genera from the tropical part of South America: *Brasilogovea* Martens, 1969; *Canga* DaSilva, Pinto-da-Rocha & Giribet, 2010; *Huitaca* Shear, 1979; *Metagovea* Rosas Costa, 1980; and *Neogovea* Hinton, 1938. An additional Neotropical genus, *Sirula* Goodnight & Goodnight, 1942 was synonymized by Shear (1977). A species named ?Gen *enigmaticus* Martens, 1969, from Amazonas State in Brazil, in which no males are known, also belongs to the family. The kinship of the species *Shearogovea mexasca* (Shear, 1977), from caves in Mexico, remains questionable (Giribet, 2007), and we follow our previous work considering that it does not belong to the genus *Neogovea* or to the family Neogoveidae (Benavides and Giribet, 2007; Giribet, 2011; Giribet et al., 2012).

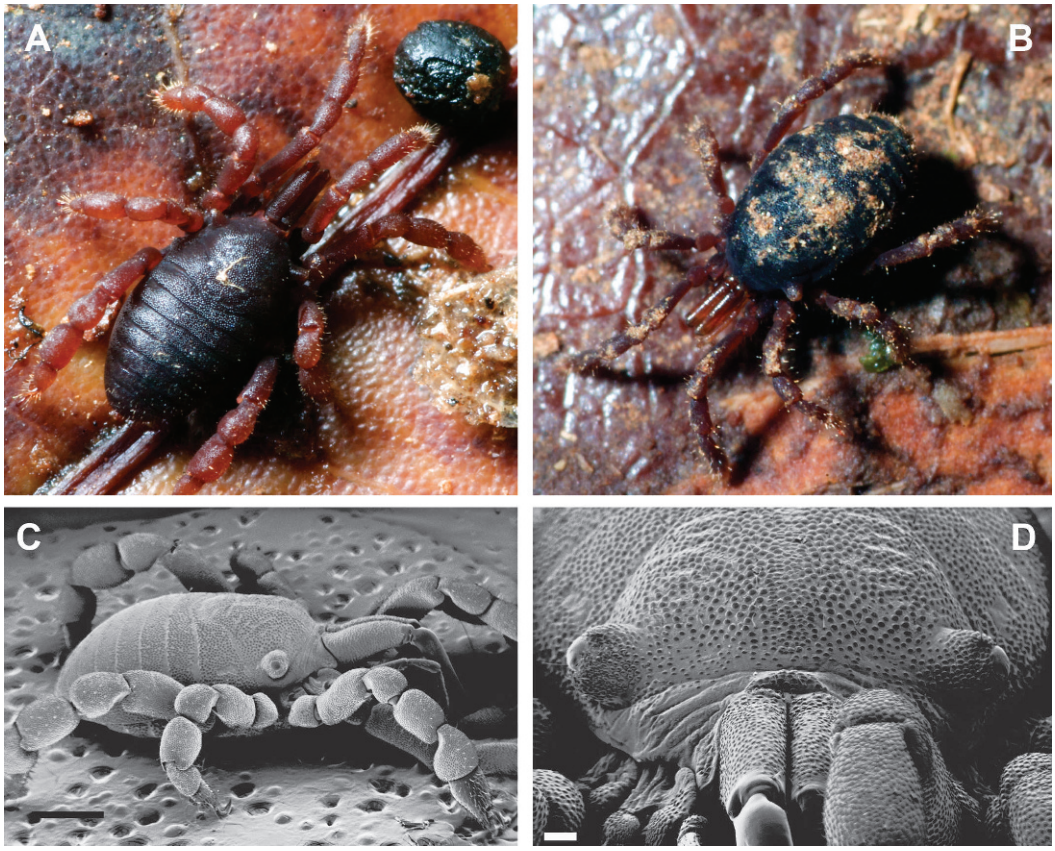

Figure 1. Habitus of different neogoveid species. (A) *Huitaca boyacaensis* new species from Departamento de Boyacá (Colombia), photographed 30 October 2004 (MCZ DNA101407). (B) *Metagovea* sp. from Departamento de Nariño, photographed 10 November 2004. (C, D) *Huitaca ventralis* from Departamento de Norte de Santander (MCZ DNA101674).

Currently the family Neogoveidae (see habitus of selected species in Fig. 1) comprises 15 species (Benavides and Giribet, 2007; Pinto-da-Rocha and Giribet, 2007; DaSilva et al., 2010; Jocqué and Jocqué, 2011) known mostly only from their type localities, but approximately 40 additional Neotropical species including the ones described here (Benavides and Giribet, 2007) and at least six from West Africa (Giribet et al., 2012) are known and remain undescribed.

Morphologically the members of the family Neogoveidae are recognized by their oval shape, the position of the ozophores (type II of Juberthie, 1970), the absence of eyes, the fused coxae of legs II–IV (*Canga* and *Metasiro* are exceptions, with free coxae II), circular spiracles, and when present, secretory glands located in the anterior opisthosomal sternites (but in the anal region in *Metasiro*), a corona analis formed by complete fusion of sternites 8 and 9 and tergite IX (not in *Metasiro*), distal segment of the chelicera robust and short or long and slender, second segment smooth, a solea in the tarsus of leg I, claw II with a row of teeth forming a comb, metatarsus of all legs always ornamented and the metatarsus IV of males undivided (Giribet, 2007).

History of Knowledge of the Neotropical Neogoveids

The first South American neogoveid, *Neogovea kartabo* (Davis, 1937), was described

from Guyana under the genus *Siro* Latreille, 1796. A year later, Hinton (1938) described the new genus *Neogovea* Hinton, 1938 on the basis of the new species *Neogovea immsi* Hinton, 1938, from Pará State (Brazil)—the type species of the genus by original designation. Goodnight and Goodnight (1942) erected the new genus *Sirula* for Davis' *Siro kartabo*, unaware of the existence of Hinton's *Neogovea*, which thus is a senior synonym of *Sirula*. Rosas Costa (1950) described the new genus *Metagovea* Rosas Costa, 1950 for a new species from Colombia, *M. disparunguis* Rosas Costa, 1950—the whereabouts of the type specimens of this species are unknown (Giribet, 2000). Rosas Costa (1950) placed *Metagovea* and *Neogovea* in the family Stylocellinae, along with the African *Parogovia*[1] and the Southeast Asian genera *Miopsalis* and *Stylocellus*, but accepted *Sirula* and placed it within the subfamily Sironinae (then including the current members of the families Pettalidae and Sironidae, plus *Metasiro* [as *Neosiro*]).

In the first revision of South American neogoveids, Martens (1969) described all the known species from Amazonas State in Brazil, adding a new genus to the list, *Brasilogovea* Martens, 1969, and a new *Metagovea* species, *M. oviformis* Martens, 1969. A species named ?Gen *enigmaticus* Martens, 1969, with no males known, also belongs to the family, although this species name is not valid under the International Commission on Zoological Nomenclature. No specimen of any of these species has been reported since Marten's original descriptions. Shear (1977) provided the first revision of the genus *Neogovea*, synonymized *Sirula* with *Neogovea*, and described two new species, *N. kamakusa* Shear, 1977 from Guyana and *N. mexasca* Shear, 1977. The latter species was transferred to *Shearogovea* Giribet, 2011, as it constitutes an unusual troglobitic species from a cave in Oaxaca (Mexico) (Giribet, 2011). *Shearogovea mexasca* is now not considered a member of Neogoveidae (Giribet, 2011). A new monotypic genus from Colombia, *Huitaca* Shear, 1979, "closest to *Metagovea*" (Shear, 1979), followed for the species *H. ventralis* Shear, 1979. A year later, in his seminal Cyphophthalmi revision, Shear (1980) synonymized *Brasilogovea* with *Neogovea* and proposed, on the basis of a cladistic analysis of morphological characters, a new classification system for Cyphophthalmi, placing the Neotropical genera *Metagovea* and *Neogovea* with the African *Parogovia* in the new family Neogoveidae Shear, 1980, and *Huitaca* with the African genus *Ogovea* in the new family Ogoveidae Shear, 1980. Neogoveidae and Ogoveidae were proposed as sister families, related to the Southeast Asian Stylocellidae in a clade named Tropicophthalmi Shear, 1980.

[1] In the first part of his wonderful "Studies on Arthropoda," Hansen (1921) published the description of the new cyphophthalmid genus *Parogovia* Hansen, 1921: 44–46, which included the new species *P. sironoides* Hansen, 1921: 46–49, pl. IV, figs 2a–2l. The species and genus were based on two specimens collected in Bioko (formerly Fernando Póo), Equatorial Guinea; a male from Punta Frailes and a female from Pico Basilé, both collected by Leonardo Fea in 1901, while "exploring partly unhealthy countries in tropical West Africa" (Hansen, 1921: 7). In the same article he described *Ogovia nasuta* Hansen, 1921: 39–44, pl. III, figs. 4a–4c, pl. IV, figs. 1a–1f, the second species for the genus *Ogovia* Hansen and Sørensen, 1904: 99–100. *Ogovia* was, however, a preoccupied name for *Ogovia* Holland, 1892. Roewer (1923: 48) provided the replacement name *Ogovea* Roewer, 1923, a name used since then (Roewer, 1927: 263). Cloudsley-Thompson (1958: 134) misspelled *Ogovea* (as *Ogivea*) and *Parogovia* (as *Paragovia*). Although the former misspelling was not perpetuated in the literature, the latter name has appeared in a series of publications, including all recent catalogues and revisions of Cyphophthalmi (Rosas Costa, 1950; Shear, 1980; Giribet, 2000) and several phylogenetic analyses of the group (Shear, 1980; Giribet and Boyer, 2002; de Bivort and Giribet, 2004; Boyer et al., 2005, 2007; Boyer and Giribet, 2007; Clouse and Giribet, 2007; Sharma and Giribet, 2009a). The only modern reviews of the African neogoveid fauna are those of Juberthie (1969) and Legg (1990). Juberthie (1969) described *Metagovea gabonica* Juberthie, 1969: 80–88, figs 1–7, from Gabon, later transferred to *Parogovia* by Legg (1990), who described a third species in the genus, *P. pabsgarnoni* Legg, 1990: 117–120, figs 11–19, pls. 1–11. Legg (1990) already noted the misspelling of *Parogovia* by several authors (Rosas Costa, 1950), but Giribet and collaborators did not notice this correction and had used the named incorrectly until recently.

Despite the report of numerous undescribed species (Benavides and Giribet, 2007), three decades were needed before other Neotropical Cyphophthalmi were described, first a species in another monotypic genus from a cave in Pará State (Brazil), *Canga renatae* DaSilva, Pinto-da-Rocha & Giribet, 2010, and then another *Neogovea* species from French Guiana, *N. virginie* Jocqué & Jocqué, 2011 (DaSilva et al., 2010; Jocqué and Jocqué, 2011).

To complete the picture, in 1933, a new Cyphophthalmi species was described from Torreya State Park in Florida (Davis, 1933), *Siro americanus* Davis, 1933, later transferred to *Parasiro* by Hinton (1938), and subsequently to its own monotypic genus twice, *Metasiro* Juberthie, 1960 and *Floridogovea* Hoffman, 1963, the latter being a junior synonym of *Metasiro* (Juberthie, 1960; Hoffman, 1963). Although its distribution range has been considerably enlarged (Shear, 1980), the genus is still monotypic. This species, however, has seldom been discussed in the context of neogoveid systematics, as it was traditionally placed in the Holarctic family Sironidae.

Finally, in a recent analysis of cyphophthalmid phylogeny and biogeography, Giribet et al. (2012) resurrected Marten's genus *Brasilogovea* and proposed a new classification system for Opiliones, where Neogoveidae and Ogoveidae (Ogoveoidea of Shear, 1980) constitute the sister clade to Troglosironidae, a clade named Sternophthalmi Giribet, Sharma, Benavides, Boyer, Clouse, de Bivort, Dimitrov, Kawauchi, Murienne, & Schwendinger, 2012.

Phylogenetics of the Neotropical Neogoveids

On the basis of a cladistic analysis of morphological characters, Shear (1980) divided the suborder Cyphophthalmi into two new infraorders: Temperophthalmi Shear, 1980 (=Sironini of Hansen and Sørensen, 1904) and Tropicophthalmi Shear, 1980 (=Stylocellini of Hansen and Sørensen, 1904), the latter including the superfamilies Stylocelloidea Hansen & Sørensen, 1904 and a new superfamily Ogoveoidea Shear, 1980, for the two new families Neogoveidae and Ogoveidae. Neogoveidae, as defined by Shear (1980), contained the genera *Metagovea*, *Neogovea*, *Parogovia*, and ?Gen *enigmaticus*. Within the family Ogoveidae, Shear (1979) placed the genus *Ogovea* Roewer, 1923 from West Africa, and his monotypic genus *Huitaca*. *Metasiro* was classified with the Holarctic members of the family Sironidae.

In a first cladistic morphological analysis of the cyphophthalmid genera Giribet and Boyer (2002) questioned the relationship of *Ogovea* with *Huitaca* proposed by Shear (1979), who established the type of sternal secretory organs, the robust chelicerae, and the ensiform setae of the apical group of the male spermatopositor organ as putative synapomorphies for the family. Giribet and Boyer (2002) found that sternal secretory organs appeared in all males of *Metagovea* and *Parogovia* (Neogoveidae), and the chelicerae of *Huitaca* are not robust as in *Ogovea*, but attenuate, as in many species of *Neogovea.* In addition, the spermatopositor structures and distribution of setae were different in *Huitaca* and *Ogovea*, contradicting a putative synapomorphy proposed by Shear (1979).

Huitaca was thus transferred to Neogoveidae by Giribet and Prieto (2003) on morphological grounds, a result compatible with recent molecular analysis (Boyer et al., 2007) that suggested that *Huitaca* was closest to *Metagovea*[2], as originally suggested by Shear (1979) when he described the genus, with *Parogovia* nesting outside of a South American clade—although the position of *Ogovea* remained untested by molecular evidence in that study.

The analysis of Boyer et al. (2007) showed a monophyletic Neogoveidae divided in two main clades, one formed by the African (*Parogovia*) and North American (*Metasiro*)

[2] The species named *Neogovea* in that study are now interpreted as part of the diversity of the *Metagovea* clade—see discussion below.

members of the family and the second lineage composed by the South American species, with the New Caledonian endemic *Troglosiro* Juberthie, 1979 constituting the sister group of Neogoveidae. Nevertheless, the relationships between the South American species remained largely unresolved because of limited taxon sampling, and the generic designations of that study were tentative for the South American species. The study of Boyer et al. (2007) was restricted to five South American neogoveids (four from Colombia and one juvenile of uncertain affinity from Venezuela). At that time the Colombian species were identified to belong to the monotypic genus *Huitaca* (one new species), *Metagovea* (one new species), and *Neogovea* (see Benavides and Giribet, 2007). However, the Colombian species identified as *Neogovea* in our previous studies appear to be related to *Metagovea*. A large biogeographic gap in our previous studies was the easternmost distribution of the family, the area that hosts the real *Neogovea* (type species *N. immsi*, from Amapá, Brazil). A new analysis from Giribet et al. (2012) included putative representatives of this clade on the basis of three specimens collected in French Guiana, including two collections of the recently described species *N. virginie*. The unidentified juvenile from Venezuela used in Boyer et al. (2007) and the new species from the Tepuis in Colombia described below were assigned to the genus *Brasilogovea* (see discussion below), which constitutes the sister clade to *Neogovea*. Finally, this analysis included data on the monotypic genus *Canga*, additional specimens of *Metasiro*, and additional African neogoveids, as well as the first sequences of the family Ogoveidae (Giribet et al., 2012).

Ogoveidae was left as a monogeneric family by Giribet and Prieto (2003), when *Huitaca* was transferred to Neogoveidae, and includes three species from Equatorial Guinea, Gabon, and Cameroon (Hansen and Sørensen, 1904; Hansen, 1921; Giribet and Prieto, 2003). We visited locations near the imprecise localities of *Ogovea grossa* (Hansen & Sørensen, 1904) (mid-section of the Ogoué River, Gabon), *O. nasuta* (Hansen, 1921) (Musola, Bioko, Equatorial Guinea), and the type locality of *O. cameroonensis* Giribet & Prieto, 2003 (Ototomo forest, Yaoundé region, Cameroon), and only the latter yielded specimens (L. Benavides, G. Giribet, J. Murienne, June 2009). The family Ogoveidae was supported as sister to Neogoveidae, with Troglosironidae nesting outside (Giribet et al., 2012). *Metasiro* appeared as either the sister group to all other neogoveids in most analyses, with one exception, where it was sister to *Canga* in the combined analysis of molecules and morphology (Giribet et al., 2012).

The detailed phylogenetic results for these analyses are presented elsewhere (Giribet et al., 2012), but a summary chronogram illustrating the phylogeny of the family (Fig. 2) is the basis of our taxonomic propositions. All analyses agree in that *Canga* does not form a clade with the remaining South American species, and instead it appears more closely related to the African species (in all analyses except in the total evidence one), constituting a relictual member of a clade that diversified during the Triassic (Giribet et al., 2012). The main South American clade, of similar age, is stable to analytical method, model, or parameter set, and has the structure shown in Figure 2: ((*Brasilogovea*, *Neogovea*), (*Huitaca*, *Metagovea*)). Following this phylogenetic framework, in this article we provide a redescription of the Neotropical neogoveid genera from this clade, and describe six species of *Huitaca*, one *Neogovea*, and one *Brasilogovea*.

MATERIALS AND METHODS

Repository Institutions are abbreviated as follows: MCZ, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts. The male holotype and a female paratype of each species were photographed in dorsal, ventral, and lateral views, using either a JVC KY-F70B digital camera mounted on a Leica MZ 12.5 stereomicroscope, or a Leica DFC425 digital camera

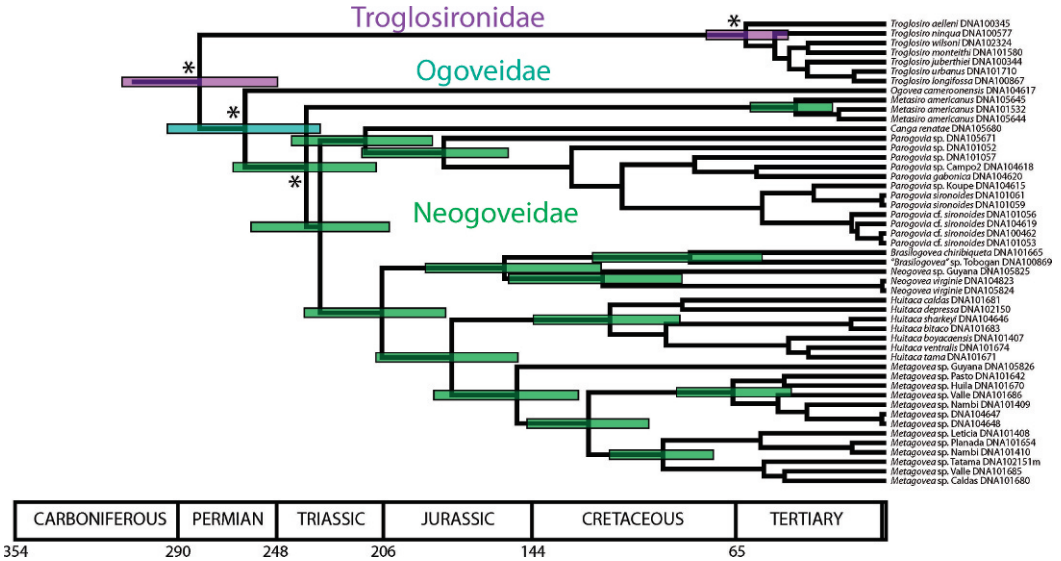

Figure 2. Chronogram of Sternophthalmi obtained from Giribet et al. (2012). Troglosironidae (purple), Ogoveidae (pastel green), and Neogoveidae (green). South American Neogoveidae appear in two clades, *Canga* as sister group to the African species, and the remaining South American species form a clade that diversified during the Triassic/Jurassic.

mounted on a Leica M205A stereomicroscope when available. A series of images (8 to 10) were taken at different focal planes and assembled with the dedicated software package Auto-Montage Pro Version 5.00.0271 (Syncroscopy, Frederick, Maryland) or the Leica Application Suite V3.0 Software (Leica Microsystems, Switzerland).

For scanning electron microscopy (SEM) the specimens (including at least one male paratype for the new species) were sputter-coated with gold–palladium. Images were taken using an FEI Quanta 200 microscope at the Center for Nanoscale Systems (CNS) at Harvard University, Cambridge; a Hitachi microscope in the Microscope Imaging Facility at The American Museum of Natural History (AMNH), New York; or a LEO 1430VP microscope at the Department of Biological Sciences at The George Washington University, Washington, D.C. Total body length was measured dorsally from the anterior to the posterior border of the body and along the midline. Length measurements of leg and pedipalp articles were taken dorsally, from anterior to posterior, along the midline; widths (depths) on the lateral side, at the widest portion, except for tarsus IV of the male, which was measured at the distal point of insertion of the adenostyle. Tarsal length does not include the claw. Body measurements were taken using the holotype and female paratype images. All appendage measurements were taken from the paratype specimens studied under SEM. All measurements are given in millimeters unless otherwise indicated. Figure 3 shows the distribution of the known (described and undescribed) Neotropical neogoveids.

TAXONOMY

Order Opiliones Sundevall, 1833
Suborder Cyphophthalmi Simon, 1879
Infraorder Sternophthalmi Giribet, Sharma, Benavides, Boyer, Clouse, de Bivort, Dimitrov, Kawauchi, Murienne, & Schwendinger, 2012
Superfamily Ogoveoidea Shear, 1980
Family Neogoveidae Shear, 1980
Genus *Brasilogovea* Martens, 1969

Type Species. *Brasilogovea microphaga* Martens, 1969 by original designation.

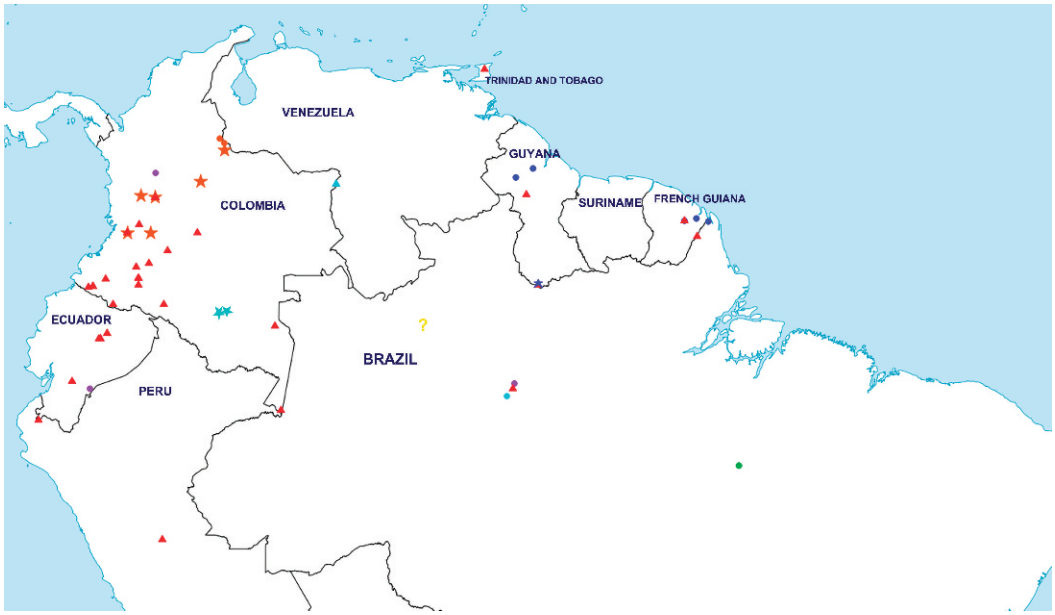

Figure 3. Distribution map of South American Neogoveidae. Species described before this paper appear as circles, new species described here as stars (the two *Brasilogovea* stars are different localities for the same species; the three *Huitaca* circles represent three localities for *H. ventralis*), and undescribed species as red triangles. Colors indicate the different genera: *Brasilogovea* (turquoise), *Canga* (green), *Huitaca* (orange), *Metagovea* (purple), and *Neogovea* (blue). ?Gen *enigmaticus* is represented by a yellow question mark.

Emended Diagnosis. Opisthosomal middorsal longitudinal sulcus inconspicuous. Coxae of legs I free; coxae of legs II–IV fused, as in *Huitaca*, *Neogovea*, and *Metagovea*, but readily distinguishing *Brasilogovea* from *Canga* and *Metasiro*. Adenostyle ending in a brush of setae, as in *Neogovea* and distinguishing it from the genera *Huitaca* and *Metagovea*, with lamelliform adenostyles, and located toward the center of the dorsal side of tarsus IV. Sternum present, as in some *Neogovea*, but unlike *Huitaca* and *Metagovea*. Sternites 8 and 9 and tergite IX all fused into a corona analis, distinguishing it from *Metasiro*. Opisthosomal exocrine glands present, as in *Metagovea* and *Huitaca*, distinguishing it from *Neogovea*, *Canga*, and *Metasiro*. Spermatopositor with a semicircular ventral plate and two curved movable fingers protected by long microtrichiae and an elongated flat dorsal plate with expanding bilobed tip, not cuticularized.

Notes. *Brasilogovea* is closely related to *Neogovea* (Fig. 2), forming a clade of Amazonian species with adenostyles ending in a brush of setae, but they differ from *Neogovea* in the presence of opisthosomal exocrine glands in the sternal region of *Brasilogovea*; however, these glands are less conspicuous than those of *Huitaca*. *Brasilogovea* was synonymized with *Neogovea* by Shear (1980) due to many similarities in adenostyle structure as well as overall similarity of the spermatopositor. Although the structure of the spermatopositor of *B. microphaga* and *B. chiribiqueta* new species is clearly similar and differs greatly from that of *Neogovea*, the new species also has an exocrine opisthosomal gland homologous to that of *Huitaca* and *Metagovea*, although it is much less conspicuous than that of *Huitaca*. Although Martens (1969) did not describe this organ for *B. microphaga*, the organ was also not described for any *Metagovea* or *Parogovia* because it is difficult to observe without SEM. The organ is also homologous to those of *Troglosiro* and *Ogovea* (Giribet et al., 2012), and constitutes

a synapomorphy for Sternophthalmi. The male holotype is the only known adult specimen of *B. microphaga* and the opisthosomal sternal region was dissected out and is not preserved. The two genera *Brasilogovea* and *Neogovea* may have diversified during the Jurassic (Fig. 2), a time comparable with that of the divergence of *Huitaca* and *Metagovea*.

Included Species: B. microphaga Martens, 1969 and *B. chiribiqueta* new species. Phylogenetic evidence on the basis of molecular data supports a sister group relationship of *B. chiribiqueta* new species and the juvenile from Tobogán de la Selva (MCZ DNA100869) and therefore we tentatively consider the latter a member of the genus.

Brasilogovea chiribiqueta New Species

Figures 4–6, 29A

Type Specimens

Holotype. Male (MCZ DNA101665) from rivers Cunaré and Amú (0°12′43″N, 72°28′3″W), Parque Nacional Natural Serranía de Chiribiquete, Solano, Departamento de Caquetá (Colombia), 300 m, E. González leg.

Paratypes. Eight males and 10 females (MCZ DNA101664, MCZ DNA101665, MCZ DNA101666), same collecting data as the holotype (one male and one female for DNA extraction; two males and one female dissected for genitalia; one male and one female for SEM); one male (MCZ DNA101663) from Río Saramano (0°10′55″N, 72°36′31″W), Parque Nacional Natural Serranía de Chiribiquete, Solano, Caquetá (Colombia), 300 m, E. González leg.; one female (MCZ DNA101662) from river Saramano (0°10′47″N, 72°37′24″W), Parque Nacional Natural Serranía de Chiribiquete, Solano, Caquetá (Colombia), 300 m, E. González leg.

Etymology. The species epithet is derived from the Chiribiquete region, in the northwestern portion of the Amazon Basin of Colombia, Guyana Shield.

Diagnosis. The holotype of *B. microphaga* is poorly preserved, its sternal opisthosomal region being missing; therefore we were unable to identify any sternal organ or gland. In addition, no spermatopositor was found in the vial containing the holotype. However, by comparing the drawings and description of the spermatopositor of *B. microphaga* in Martens (1969) and the new species described here, it is evident that both spermatopositors are similar in the position and number of microtrichiae, but *B. chiribiqueta* is missing the four distal-most microtrichiae on the dorsal side and the single central microtrichia on the ventral side that are present in the spermatopositor of *B. microphaga* (Martens 1969: figs. 15–17).

Description of Male. Total length of male holotype (in mm): 3.19; largest body width in third opisthosomal segment: 1.47; length/width ratio (L/W) = 2.17; width across ozophores: 0.80, greatest width: 1.06; body brown-orange and legs slightly lighter (in ethanol). Cuticle with light tuberculate–microgranular surface (Figs. 4A–C). Ozophore conical of type II (*sensu* Juberthie, 1970) and ornamented distally (Fig. 5H). Eyes absent. Opisthosomal mid-dorsal longitudinal sulcus inconspicuous (Fig. 4A). Ventral prosomal complex (Fig. 5C) with coxae I free, coxae II, III, IV fused; coxae I with a small tooth on its proximal interior edge (Fig. 5G); gonostome oval and with two conical toothlike projections on its posterior edge (Fig. 5C); sternum present. Coxal pores present between coxae III and IV (Fig. 5C). Spiracles circular (Fig. 5F) (*sensu* Giribet and Boyer, 2002). Ventral opisthosomal area with an exocrine gland located behind the gonostome (Figs. 5A, C); this exocrine gland appears as a small and corrugated protuberance (Fig. 5E). Opisthosomal tergite IX and sternites 8 and 9 fused into a corona analis (Fig 5I). Anal plate oval, with several small brushlike tubercles (Figs. 5K, L). These modified tubercles are present throughout sternites 5–9 and tergite IX, but its highest density is present along sternites 7–9 and the anterior part of the anal plate.

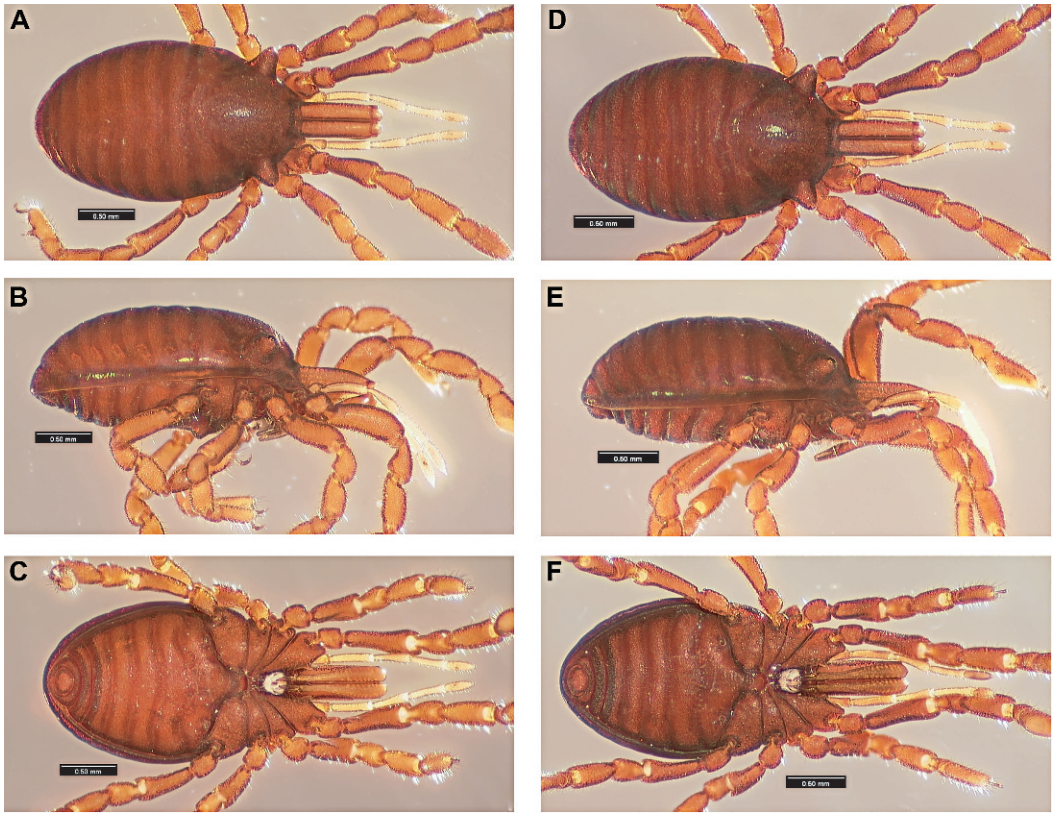

Figure 4. *Brasilogovea chiribiqueta* new species. (A–C) Holotype male (MCZ DNA101665) in dorsal (A), ventral (B), and lateral (C) view. (D–F) Paratype female (MCZ DNA101664) in dorsal (D), ventral (E), and lateral (F) view. Scale bars 500 μm.

Proximal cheliceral segment with a hook-like dorsal crest and with a single ventral process, and ornamented densely toward its half-proximal area (Fig. 6A). Widest part of the second cheliceral segment near its base and without ornamentation; cheliceral distal segments with special dentition with bicuspidate teeth in the mobile digit, and alternation of large and small nodular teeth in the fixed digit (*sensu* de Bivort and Giribet, 2004). Pedipalp (Fig. 6C) 1.3 mm long, slender, sparsely ornamented in the femur, abundant presence of setae in the tarsus and fewer setae in the tibia; trochanter without ventral apophysis. Pedipalp measurements of male paratype in millimeters; length/width (L/W ratio): trochanter: 0.24/0.09 (2.67); femur: 0.31/0.08 (3.88); patella: 0.24/0.08(3.00); tibia: 0.27/0.06 (4.5); tarsus: 0.24/0.07 (3.42). Legs robust (Figs. 6D–G; measurements in Table 1); leg formula I, II, IV, III. Patella, tibia, metatarsus, and tarsus of all legs densely ornamented; trochanter and femur less densely granulated; tarsi III and IV less granulated than metatarsus. All legs with setae, the highest concentration of setae occurring along the tarsus of all four walking legs (Figs. 6H–K). Tarsus I with a distinct solea (Fig. 6H). Tarsus of leg IV entire (Fig. 6K), with a plumose adenostyle positioned toward the first third of the dorsal side on tarsus IV (Fig. 6L). Tarsus of leg IV with distinct aggregations of pores along its ventral side (Figs. 6K, M, N). Claw of leg II with a distinct row of four teeth, and lateral pegs (Fig. 6I); lateral pegs present in both sides of all claws, almost toothlike in legs III and IV (Figs. 6J, K, O).

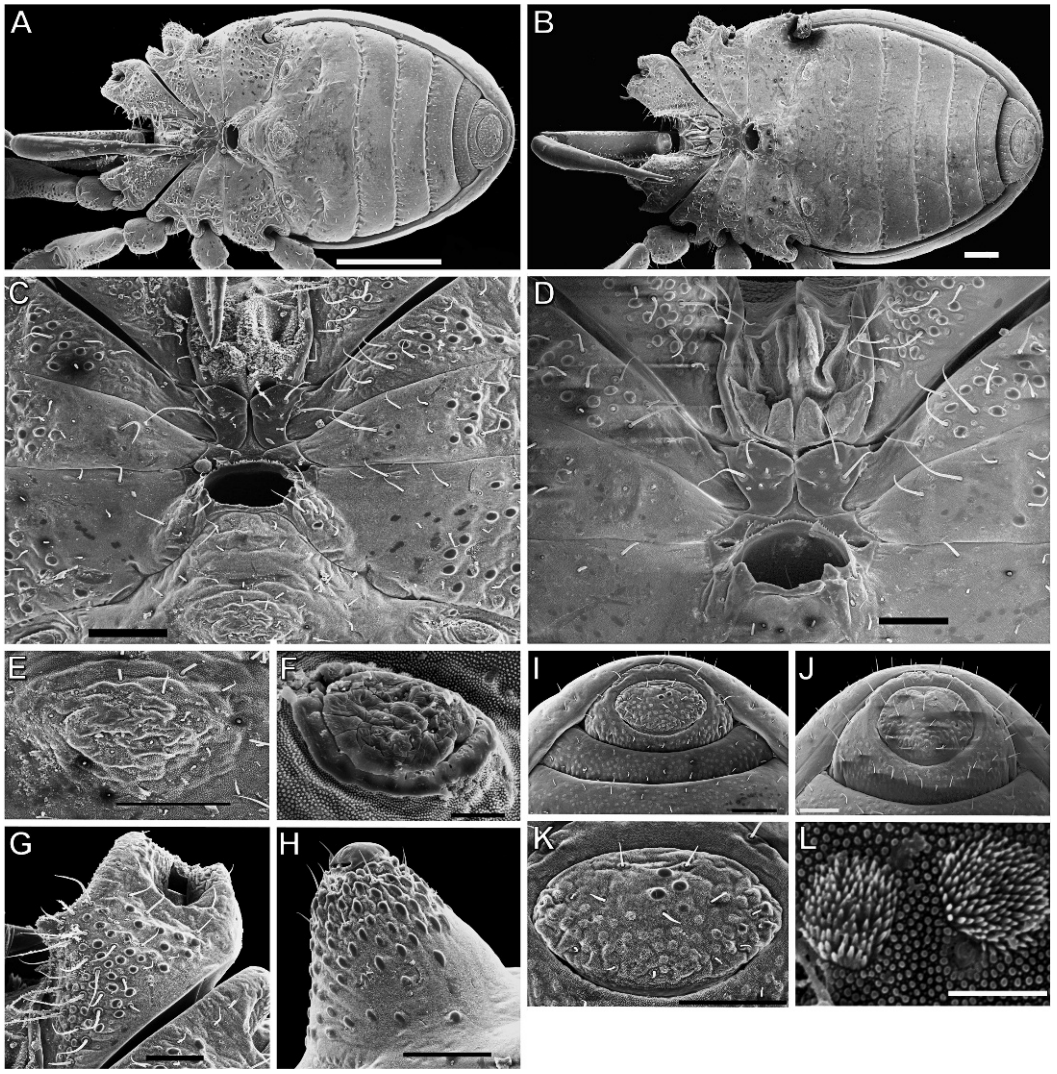

Figure 5. *Brasilogovea chiribiqueta* new species. Paratype male and female (MCZ DNA101664). (A) Paratype male in ventral position. (B) Paratype female in ventral position. (C) Male ventral thoracic complex. (D) Female ventral thoracic complex. (E) Male sternal complex showing the exocrine gland. (F) Male spiracle. (G) Detail of male first coxae showing the teeth on its proximal edge. (H) Male spiracle. (I) Male anal region. (J) Female anal region. (K) Detail of the male anal plate. (L) Detail of the conglomerates of setae on the male corona analis. (A, scale bar 500 μm; B–K, scale bars 100 μm; L, scale bar 10 μm.)

Spermatopositor (Fig. 29A) elongated, with two membranous distal fringed "wings." Dorsally with four basal long microtrichia that extend until the tip of the distal wings, the two central ones with thickened bases. Ventrally there is a plate with a semicircular edge extending to two- thirds of the spermatopositor length, without microtrichiae. Four long lateral microtrichiae are found in a cuticular expansion at each side of the spermatopositor, originating toward the middle, and extending for a length comparable with the spermatopositor length, but in a 30° angle, toward the outside.

Description of Female. Total length of female paratype (in millimeters): 3.04,

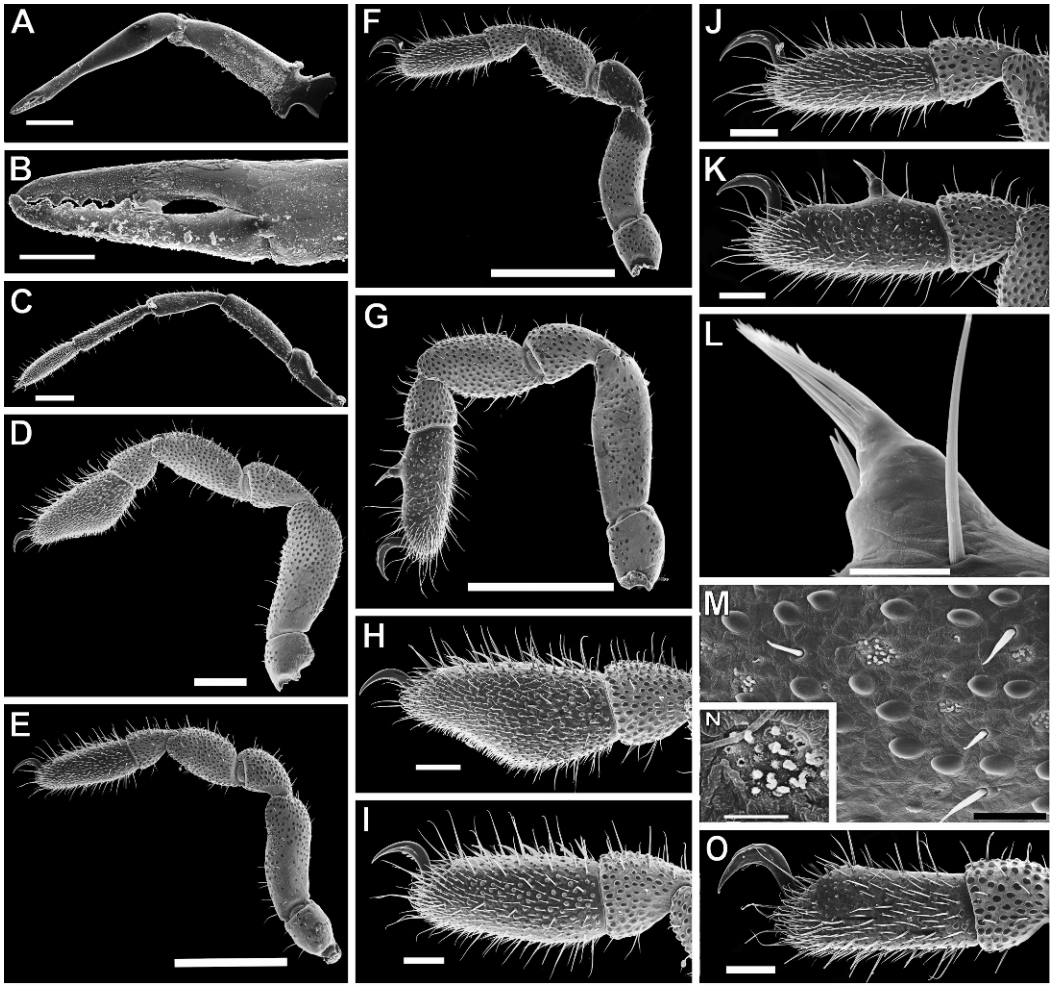

Figure 6. *Brasilogovea chiribiqueta* new species. Paratype male and female (MCZ DNA101664). (A) Left chelicera of male. (B) Detail of the cheliceral pincer. (C) Left pedipalp of male. (D) Leg I of male. (E) Leg II of male. (F) Leg III of male. (G) Leg IV of male. (H) Metatarsus and tarsus I of male. (I) Metatarsus and tarsus II of male. (J) Metatarsus and tarsus III of male. (K) Metatarsus and tarsus IV of male. (L) Male adenostyle. (M, N) Detail of the pores on the tarsus IV of male. (O) Metatarsus and tarsus IV of female. (A, D, scale bars 200 μm; B, C, scale bars 50 μm; E–G, scale bars 500 μm; H–K, O, scale bars 100 μm; L, M, scale bars 30 μm; N, scale bar 10 μm.)

largest body width toward the third opisthosomal segment: 1.29 (L/W = 2.35; Fig. 4D); ventral prosoma with a semicircular gonostome, wider than long, and with larger projections than in the male (Fig. 5D). Anal plate without conspicuous modifications, but more elongated than that of the male (Fig. 5J). Tarsus of leg IV without glandular pores or other modifications (Fig. 6O). Ovipositor not studied.

Distribution. Known only from its type locality in the Chiribiquete region of Colombia (turquoise stars in Fig. 3).

Notes. Since the species from Tobogán de la Selva, Puerto Ayacucho, Estado de Amazonas, Venezuela (MCZ DNA100869) is a juvenile, the morphological characters that distinguish this species from *B. chiribiqueta* cannot be discussed at this time.

TABLE 1. LEG MEASUREMENTS OF MALE PARATYPE MCZ DNA101664: L = LENGTH, W = WIDTH, L/W = L/W RATIO.

	Trochanter			Femur			Patella			Tibia			Metatarsus			Tarsus			
Leg	L	W	L/W	L	W	L/W	L	W	L/W	L	W	L/W	L	W	L/W	L	W	L/W	Total
I	0.25	0.20	1.25	0.59	0.26	2.27	0.30	0.20	1.50	0.43	0.20	2.15	0.26	0.20	1.30	0.45	0.23	1.95	2.28
II	0.26	0.19	1.36	0.55	0.22	2.50	0.29	0.18	1.61	0.36	0.21	1.71	0.23	0.18	1.28	0.44	0.18	2.44	2.13
III	0.23	0.19	1.21	0.46	0.18	2.56	0.24	0.16	1.50	0.34	0.22	1.54	0.21	0.14	1.50	0.36	0.13	2.76	1.84
IV	0.23	0.19	1.21	0.59	0.20	2.95	0.30	0.20	1.50	0.37	0.21	1.76	0.19	0.16	1.19	0.42	0.18	2.33	2.10

Genus *Neogovea* Hinton, 1938

Type Species. *Neogovea immsi* Hinton, 1938 by original designation.

Emended Diagnosis. Opisthosomal middorsal longitudinal sulcus conspicuous or inconspicuous. Coxae of legs I free; coxae of legs II–IV fused, as in *Brasilogovea*, *Huitaca*, and *Metagovea*, but readily distinguishing *Neogovea* from *Canga* and *Metasiro*. Adenostyle ending in a brush of setae, as in *Brasilogovea* and distinguishing it from the genera *Huitaca* and *Metagovea*, with lamelliform adenostyles; the adenostyle is located at the base or toward the center of the dorsal side of tarsus IV. Sternum present or absent. Sternites 8 and 9 and tergite IX all fused into a corona analis, distinguishing it from *Metasiro*. Opisthosomal exocrine glands absent, as in *Canga*, readily distinguishing *Neogovea* from *Brasilogovea*, *Metagovea* and *Huitaca*. Spermatopositor complex with a crown-shaped structure at the tip, with additional perpendicular projections.

Notes. *Neogovea* is closely related to *Brasilogovea*, forming a clade of Amazonian species with adenostyles ending in a brush of setae, but they differ in the lack of opisthosomal exocrine glands in *Neogovea*, which are located behind the gonostome in *Brasilogovea* (as in *Huitaca* and *Metagovea*; they are located in the anal region in *Metasiro* and absent in *Canga*). Although *N. immsi*, the type species of the genus, and its close relative *N. virginie* clearly lack opisthosomal anal glands (also see *N. hormigai* new species), it is difficult to establish the lack of this character in the other two members of the genus (*N. kamakusa* and *N. kartabo*) since the opisthosomal sternal region of the only known males had been dissected to study their genitalia. However, the spermatopositor of *N. kartabo* differs markedly from that of the other species, and we do not discard the possibility of it belonging to *Brasilogovea*, whose spermatopositor is similar.

Included species: N. immsi by original designation and monotypy, *N. hormigai*, *N. kamakusa*, *N. kartabo*, and *N. virginie*.

Neogovea hormigai New Species

Figures 7–9, 29B

Type Specimens

Holotype. Male (MCZ DNA105825) from Acarai Mountains, near Romeo's Camp (1°23.282′N, 58°56.779′W), 286 m, Upper Takutu–Upper Essequibo (Guyana), 7 October 2006. T. R. Schultz & J. Sosa-Calvo leg; primary forest; rotten wood; Winkler sample TRS061007-WS10.

Paratypes. Four males and four females (MCZ DNA105825), same collecting data as holotype (one male and one female for DNA extraction; two males and one female dissected for genitalia; one male and one female for SEM).

Etymology. The species is named after Gustavo Hormiga, distinguished arachnologist and esteemed colleague, mentor, and friend for his contributions to arachnological knowledge of the Neotropics and other biogeographical regions.

Diagnosis. *Neogovea hormigai* is in the size range of *N. virginie* and *N. kamakusa*, two closely related species from French Guiana. It clearly differs from *N. kamakusa* in the position of the adenostyle, which is on

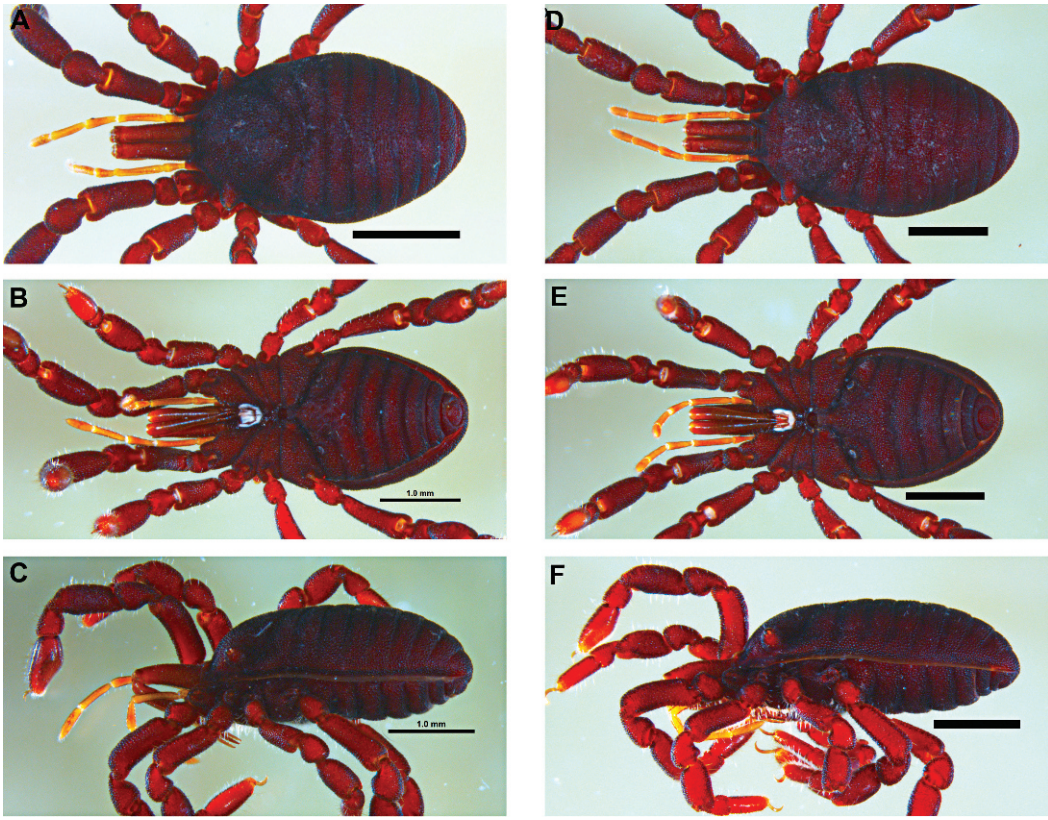

Figure 7. *Neogovea hormigai* new species. (A–C) Holotype male (MCZ DNA105825) in dorsal (A), ventral (B), and lateral (C) view. (D–F) Paratype female (MCZ DNA105825) in dorsal (D), ventral (E), and lateral (F) view. Scale bars 500 μm.

the middle of tarsus IV, and of that of *N. virginie*, which is not at the base—although it is unclear where is the exact position in that species according to the original description (Jocqué and Jocqué, 2011: fig. 3c). The sternal region of the new species also differs from that of *N. virginie*, which has a broader rhomboid sternum in the male, and a much broader pentagonal sternum in the female (Jocqué and Jocqué, 2011: figs. 5a,b). It differs from *N. kartabo* in the conspicuous longitudinal opisthosomal mid-dorsal sulcus, which is absent in the new species.

Description of Male. Total length of male holotype (in millimeters): 4.24; largest body width in opisthosomal segments III, IV: 1.95; (L/W = 2.17; Fig. 8A); width across ozophores: 1.14, greatest width: 1.40. Body color burgundy and legs dark red (in ethanol, Figs. 7 A–C). Cuticle opaque ornamented on its surface (Figs. 7A–F). Ozophores conical, of type II (*sensu* Juberthie, 1970) and ornamented throughout their surface (Fig. 8F). Eyes absent. Longitudinal opisthosomal mid-dorsal sulcus inconspicuous (Fig. 7A). Ventral prosomal complex (Fig. 8C) with sternum present; coxae I free, coxae II, III, and IV fused. Gonostome semicircular without projections, displaced anteriorly, preventing coxae IV to meet along the midline. Spiracles circular (Fig. 8G) (*sensu* Giribet and Boyer, 2002). Ventral opisthosomal area without exocrine glands or conspicuous modifications other than lack of ornamentation in the central part of sternites 2 and 3 (Fig. 8E). Opisthosomal tergite IX and

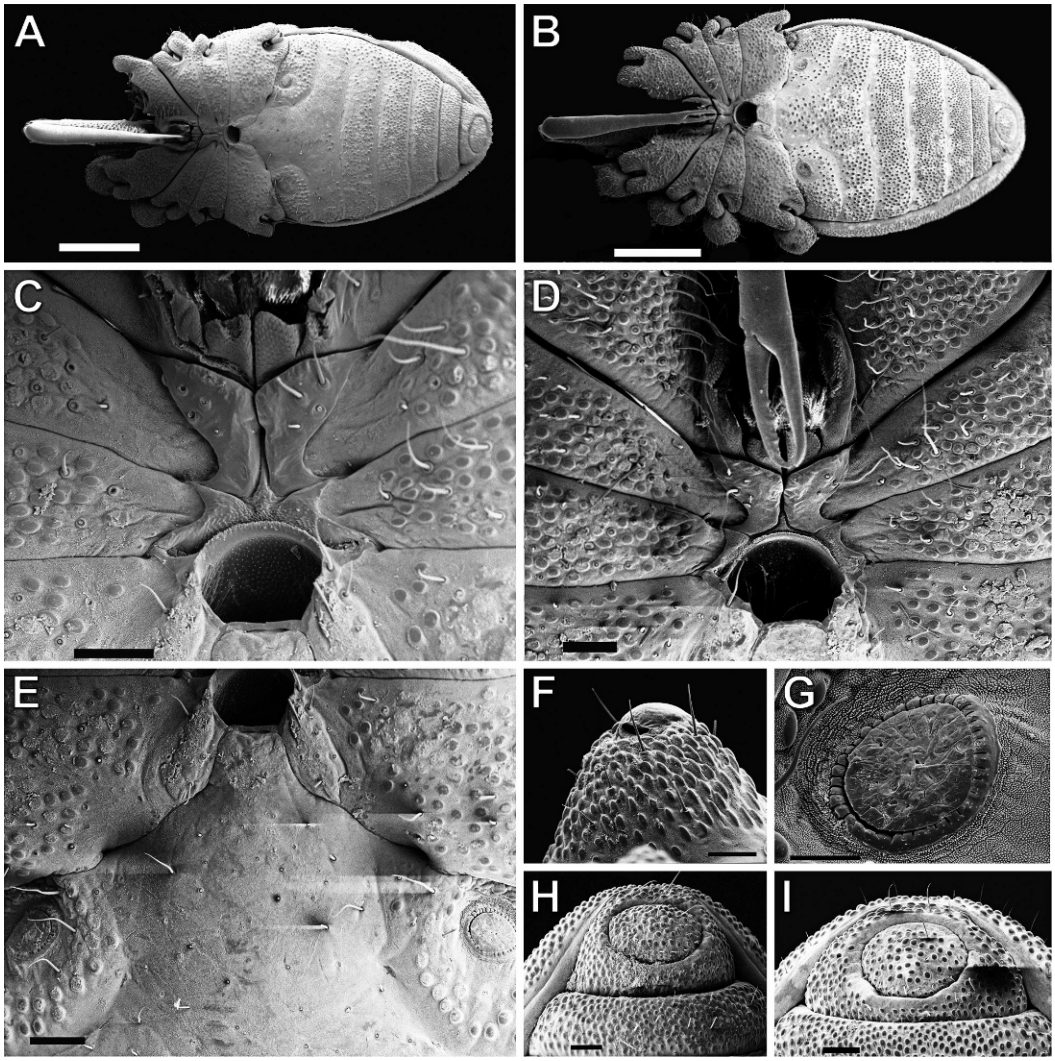

Figure 8. *Neogovea hormigai* new species. Paratype male and female (MCZ DNA105825). (A) Paratype male in ventral position. (B) Paratype female in ventral position. (C) Male ventral thoracic complex. (D) Female ventral thoracic complex. (E) Male sternal complex showing the absence of exocrine gland. (F) Male ozophore. (G) Male spiracle. (H) Male anal region. (I) Female anal region. (A, B, scale bars 500 μm; C–E, H–I, scale bars 100 μm; F, scale bar 20 μm; G, scale bar 50 μm.)

sternites 8 and 9 fused into a corona analis (Fig 8H). Anal plate oval and with conspicuous granulation; anal region without exocrine glands (Fig. 8H).

Proximal cheliceral segment with a hook-like dorsal crest and a single conspicuous ventral process; ornamented throughout its length (Fig. 9A). Second cheliceral segment smooth, with the widest part near its base; digits of the distal segment of the chelicerae with special dentition with bicuspidate teeth in the mobile digit, and alternation of large and small nodular teeth in the fixed digit (*sensu* de Bivort and Giribet, 2004) (Fig. 9B). Pedipalp measurements of male paratype in millimeters; length/width (L/W ratio): trochanter: 0.14/0.04 (3.5); femur: 0.20/0.03 (6.67); patella: 0.12/0.04 (3); tibia:

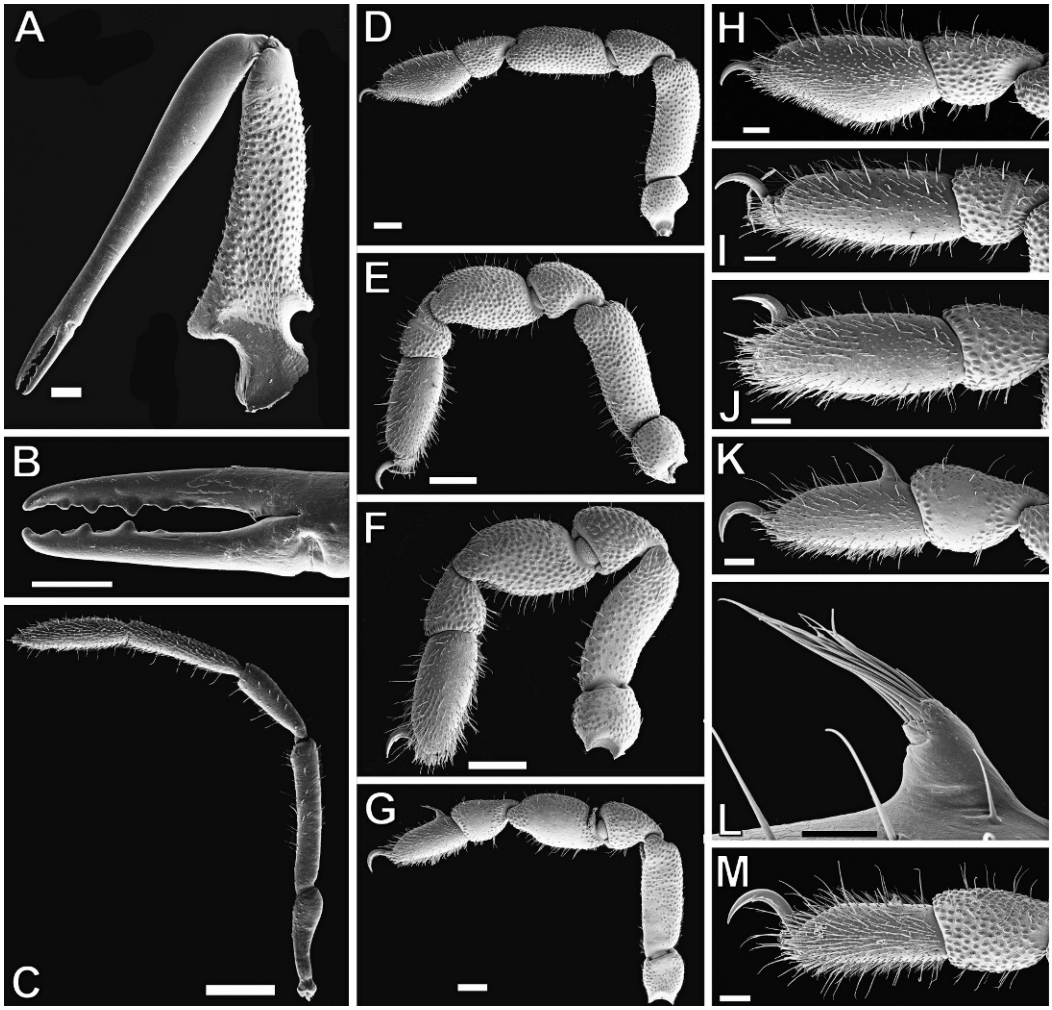

Figure 9. *Neogovea hormigai* new species. Paratype male and female (MCZ DNA105825). (A) Left chelicera of male. (B) Detail of the cheliceral pincer. (C) Left pedipalp of male. (D) Leg I of male. (E) Leg II of male. (F) Leg III of male. (G) Leg IV of male. (H) Metatarsus and tarsus I of male. (I) Metatarsus and tarsus II of male. (J) Metatarsus and tarsus III of male. (K) Metatarsus and tarsus IV of male. (L) Male adenostyle. (M) Metatarsus and tarsus IV of female. (A, C, D–K, M, scale bars 100 μm; B, scale bar 20 μm; L, scale bar 50 μm.)

0.16/0.4 (4); tarsus 0.15/0.04 (3.75). Legs robust, with all leg segments but the tarsus, densely ornamented (Figs. 9D–G). Tarsus of all four walking legs with setae along its surface, with the highest concentration of setae present along the ventral side (Figs. 9H–K); tarsus I with a distinct solea extending for more than half of the length of the tarsus (Fig. 9H). Claw of leg II with a row of five teeth (Fig. 9I); claws of all other legs with conspicuous lateral pegs (Figs. 9H, J, K, M). Tarsus IV (Fig. 9K) not divided, bearing an adenostyle ending in a brush of setae (Fig. 9L) near the proximal dorsal side. Retrolateral side of trochanter, femur, tibia, and metatarsus IV with a wide area devoid of ornamentation (Figs. 9G, K; Table 2).

Spermatopositor (Fig. 29B) slender, distal end with two triangular membranous projections. Dorsal side with two long

TABLE 2. LEG MEASUREMENTS OF MALE PARATYPE MCZ DNA105825: L = LENGTH, W = WIDTH, L/W = L/W RATIO.

	Trochanter			Femur			Patella			Tibia			Metatarsus			Tarsus			
Leg	L	W	L/W	L	W	L/W	L	W	L/W	L	W	L/W	L	W	L/W	L	W	L/W	Total
I	0.32	0.31	1.03	0.76	0.29	2.62	0.41	0.31	1.32	0.67	0.31	2.16	0.33	0.26	1.27	0.61	0.32	1.91	3.10
III	0.17	0.18	0.94	0.52	0.20	2.60	0.28	0.24	1.17	0.42	0.25	1.68	0.24	0.21	1.42	0.42	0.21	2.00	2.05
IIII	0.18	0.23	0.78	0.47	0.18	2.61	0.28	0.22	1.27	0.47	0.27	1.74	0.22	0.20	1.10	0.42	0.20	2.10	2.04
IIV	0.25	0.27	0.95	0.76	0.27	2.81	0.36	0.32	1.13	0.56	0.34	1.64	0.36	0.29	1.24	0.44	0.20	2.20	2.73

microtrichia that run from the middle part of the spermatopositor up to the base of the triangular projections. Two shorter microtrichiae originate from the middle part as well, but they are approximately one-third of the length of the first pair. Four large microtrichiae originate toward the first third terminal end of the spermatopositor, and extend until the base of the triangular projections. On the lateral sides, four long microtrichiae extend at each side from the middle of the spermatopositor up until the terminus. There are two semicircular plates on the ventral side, one of them extending up to two-thirds of the length of the spermatopositor, the other being shorter. On the ventral side, two thick projections that originate from the middle of the spermatopositor can be distinguished.

Description of Female. Total length of female paratype (in millimeters): 4.21; largest body width at third–fourth opisthosomal segment: 1.97 (L/W = 2.13; Fig. 7D); width across ozophores: 1.10, greatest width: 1.39. Ventral prosomal complex (Fig. 8D) with semicircular gonostome. Anal plate without conspicuous modifications (Fig. 8J). Tarsus of leg IV without glandular pores or other modifications (Fig. 9M). Ovipositor not studied.

Distribution. Known only from its type locality in the Acarai Mountains of Guyana (blue star in Fig. 3).

Genus *Metagovea* Rosas Costa, 1950

Type Species. *Metagovea disparunguis* Rosas Costa, 1950

Emended Diagnosis. Opisthosomal middorsal longitudinal sulcus inconspicuous. Coxae of legs I free; coxae of legs II–IV fused, as in *Brasilogovea, Huitaca, and Neogovea*, but readily distinguishing *Metagovea* from *Canga* and *Metasiro*. Adenostyle lamelliform, as in *Huitaca*, and located toward the base of the dorsal side of tarsus IV. Sternum absent, as in *Huitaca* and some *Neogovea*, but distinguishing it from *Brasilogovea*. Sternites 8 and 9 and tergite IX all fused into a corona analis, distinguishing it from *Metasiro*. Opisthosomal exocrine glands present, as in *Brasilogovea* and *Huitaca*, distinguishing it from *Neogovea*, *Canga*, and *Metasiro*. Spermatopositor with a semicircular ventral plate and two curved movable fingers protected by long microtrichiae and an elongated flat dorsal plate with expanding bilobed tip, lightly sclerotized.

Notes. The clade that includes the genus *Metagovea* is the most diverse and the most broadly distributed in the family. More than 20 undescribed species have been examined and will be described in future studies once we are able to sort out the morphological disparity within the group, as the clade includes many species formerly identified as *Neogovea* (Benavides and Giribet, 2007). Many of the characters used by Rosas Costa (1950) to define his then monotypic genus vary between the described and undescribed species of that clade. Rosas Costa did not describe the spermatopositor of *M. disparunguis* and we have been unable to locate the types, which are presumably lost. Recollection of this species is mandatory before attempting to sort out the diversity of this putative genus. We do not feel confident that the three described species of the genus may actually belong to *Metagovea*, as there seems to be a degree of character convergence due to the reduction in body size in Cyphophthalmi.

Included species: M. disparunguis Rosas Costa, 1950, *M. oviformis* Martens, 1969, and *M. philippi* Goodnight & Goodnight, 1980.

Genus *Huitaca* Shear, 1979

Type Species. *Huitaca ventralis* Shear, 1979

Emended Diagnosis. Large neogoveids with opisthosomal mid-dorsal longitudinal sulcus inconspicuous. Coxae of legs I free; coxae of legs II–IV fused, as in *Brasilogovea*, *Neogovea*, and *Metagovea*, but readily distinguishing *Huitaca* from *Canga* and *Metasiro*. Adenostyle lamelliform, as in *Metagovea*, located basally on the dorsal side of tarsus IV. Accessory organ with pores on the ventral side of tarsus IV often present, and not found in members of any other genus. Sternum absent, as in *Metagovea* and some *Neogovea* species; gonostome placed in anterior position in the sternal area not allowing coxae III to meet along the midline. Sternites 8 and 9 and tergite IX all fused into a corona analis, distinguishing *Huitaca* from *Metasiro*. Opisthosomal exocrine glands present, as in *Brasilogovea* and *Metagovea*, forming a conspicuous organ and often with modifications on several other opisthosomal sternites, unlike any other neogoveid. Spermatopositor with multiple groups of lateral microtrichiae and may have fimbriate structures around gonopore; lacking a cuticularized crownlike structure typical of *Neogovea*.

Notes. This formerly monotypic genus includes several short-range endemics from Colombia with very conspicuous excretory opisthosomal sternal modifications, which easily distinguishes the males of this genus from any other genus. This is the reason why Shear (1980) placed *Huitaca* in the family Ogoveidae, although in the original description mentioned that it was closest to *Metagovea*, as suggested by the same type of adenostyle. This was later confirmed by the molecular results reported in Giribet et al. (2012).

Included species: H. ventralis Shear, 1979, the type species of the genus, and six new species described below (orange stars in Fig. 3): *H. bitaco*, *H. boyacaensis*, *H. caldas*, H. *depressa*, *H. sharkeyi*, and *H. tama*. All species are endemic to Colombia.

Huitaca bitaco New Species

Figures 10–12

Type Specimens

Holotype. Male (MCZ DNA101683) Finca Montebello, Alto Bitaco (3°33′30″N, 76°34′58″W), 2,030 m, Municipio La Cumbre, Corregimiento Bitaco, Vereda Chicoral, Departamento del Valle del Cauca (Colombia), 31 July 2003, I. Quintero leg.

Paratypes. Two males, two females (MCZ DNA101683), same collecting data as holotype (one male, one female used for SEM, one male for DNA extraction); two males, one female (MCZ DNA101684) from Finca Montebello (3°34′08″N, 76°35′19″W), Municipio La Cumbre, Corregimiento Bitaco, Vereda Chicoral, Departamento del Valle del Cauca (Colombia), 25 July 2003, I. Quintero and E. González leg.

Etymology. The species epithet is a noun in apposition, after Bitaco, Valle del Cauca, Colombia.

Diagnosis. The presence of the cup-shaped structure in the ventral side of the male tarsus IV (Fig. 12M) places this species with *H. caldas*, *H. depressa*, and *H. sharkeyi*, but the shape of this structure differs among the species. Phylogenetically, *H. bitaco* is the sister species to the smaller species *H. sharkeyi*, from which it differs in the shape of the accessory organ of tarsus IV of the male, and in the broader posterior and anal plate. It is clearly distinguished from the species in the *H. ventralis* clade (Fig. 2) in the ornamentation of the tarsi, present in *H. bitaco*, but absent in *H. ventralis*, *H. boyacaensis*, and *H. tama*.

Description of Male. Total length of male holotype (in millimeters): 5.04; largest body width in third opisthosomal segment: 2.08 (L/W: 2.42, Fig. 10A); width across ozophores: 1.37, greatest width: 1.65. Body dark

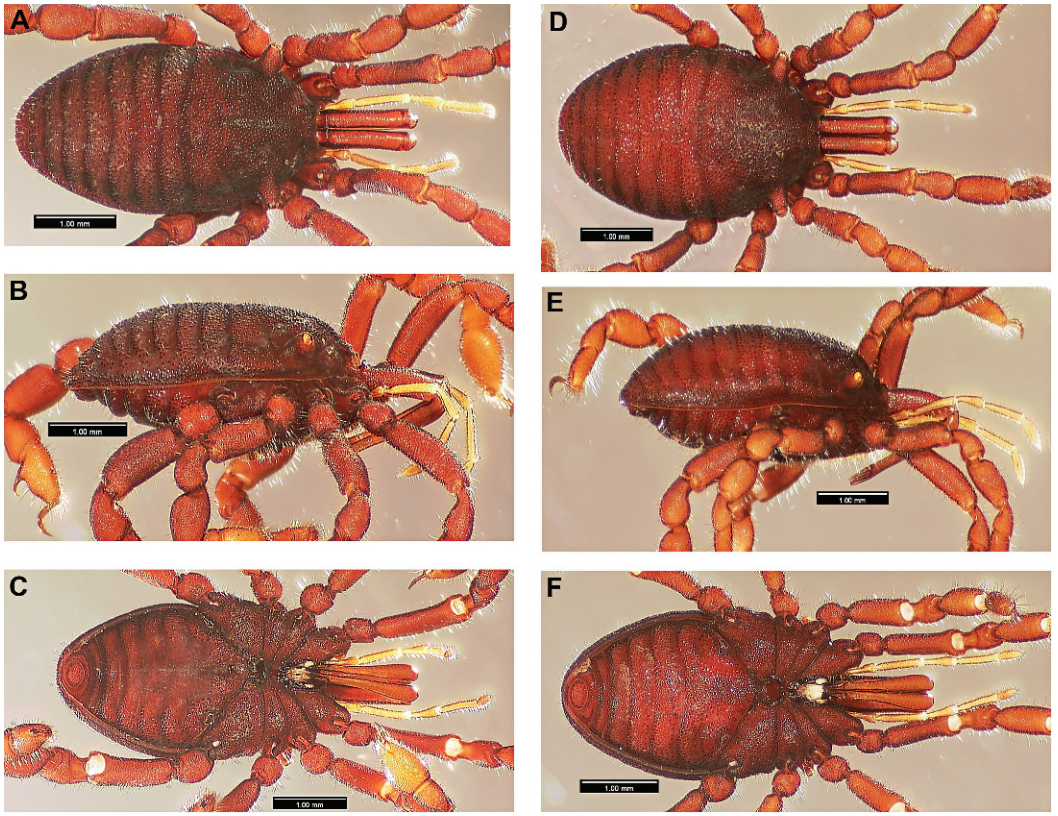

Figure 10. *Huitaca bitaco* new species. (A–C) Holotype male (MCZ DNA101683) in dorsal (A), ventral (B), and lateral (C) view. (D–F) Paratype female (MCZ DNA101683) in dorsal (D), ventral (E), and lateral (F) view. Scale bars 500 μm.

brown with lighter legs (in ethanol; Figs. 10A–C). Medium-sized cyphophthalmid without eyes or eye lenses; ozophores of type 2 (*sensu* Juberthie, 1970), entirely ornamented (Fig. 11H), with subterminal ozopore. Anterior margin of carapace concave dorsally, leaving the base of the chelicerae and the dorsal crest exposed (Figs. 10A, B). Transverse prosomal sulcus inconspicuous (Fig. 10A). Transverse opisthosomal sulci present. Mid-dorsal, longitudinal opisthosomal sulcus inconspicuous (Fig. 10A).

Coxae of legs I free, coxae of legs II–IV fused (Fig. 11A). Sternum absent (Fig. 11C). Proximal end of coxae I of males not meeting along the midline; only coxae II meeting along the midline; male gonostome oblong, delimited anteriorly by the endites of coxae III. Coxae II and III without endites running along their suture. Spiracles circular, of the closed type (Fig. 11E). Sternites 8 and 9 and tergite IX fused into a corona analis (Fig. 11A). Anal plate and anal region without conspicuous modifications or changes in ornamentation pattern. Opisthosomal sternal exocrine gland present with a large central pore in the anterior end of a ventral concave zone without ornamentation in sternites 2–5 (Figs. 11A, E); field of gland pores anterior to the largest pore (Figs. 11C, F). Hansen's organ absent, but a similar structure is found in the distal end of the anal plate (Fig. 11G).

Chelicerae slightly protruding type (*sensu* Giribet, 2003) (Figs. 10A, B), with one dorsal and one basal process (Fig. 12A), with the proximal cheliceral segment ornamented except in the distal portion; broadest part of

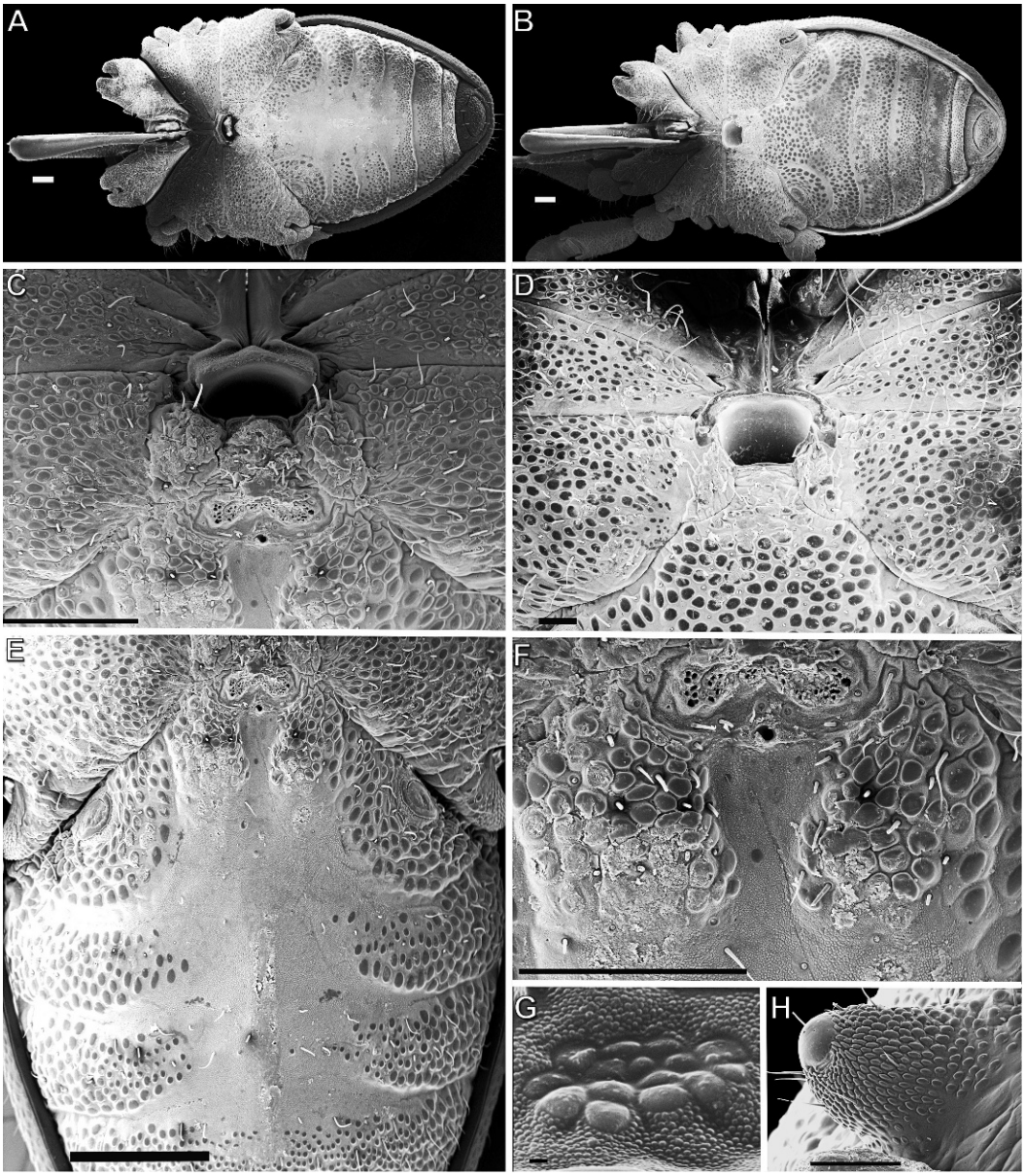

Figure 11. *Huitaca bitaco* new species. Paratype male and female (MCZ DNA101683). (A) Paratype male in ventral position. (B) Paratype female in ventral position. (C) Male ventral thoracic complex. (D) Female ventral thoracic complex. (E) Male sternal complex showing the depression along sternites 2–4. (F) Detail of the exocrine gland. (G) Detail of the anal plate area showing the accumulation of granules. (H) Male ozophore. (A, B, D, scale bars 100 μm; C, E, scale bars 500 μm; F, scale bar 300 μm; G, scale bar 1 μm; H, scale bar 20 μm.)

second cheliceral segment near the proximal end (Fig. 12A); dentition of mobile digit with bicuspidate teeth in the mobile digit, and alternation of large and small nodular teeth in the fixed digit (*sensu* de Bivort and Giribet, 2004) (Fig. 12B). Pedipalp measurements of male paratype in millimeters; length/width (L/W ratio): 0.39/0.11 (3.74);

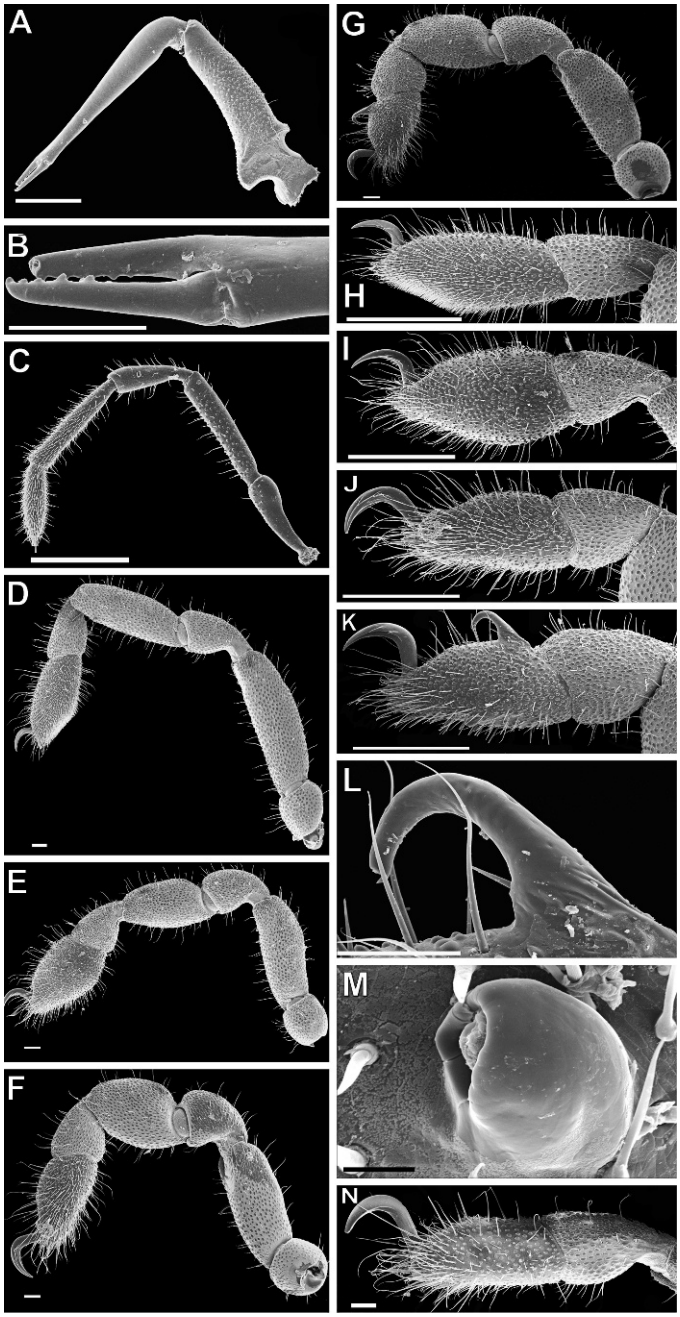

Figure 12. *Huitaca bitaco* new species. Paratype male and female (MCZ DNA101683). (A) Left chelicera of male. (B) Detail of the cheliceral pincer. (C) Left pedipalp of male. (D) Leg I of male. (E) Leg II of male. (F) Leg III of male. (G) Leg IV of male. (H) Metatarsus and tarsus I of male. (I) Metatarsus and tarsus II of male. (J) Metatarsus and tarsus III of male. (K) Metatarsus and tarsus IV of male. (L) Male adenostyle. (M) Detail of the structure in the ventral side of male tarsus IV. (N) Metatarsus and tarsus IV of female. (A, C, H–K, scale bars 500 μm; B, scale bar 200 μm; D–G, L, N, scale bars 100 μm; M, scale bar 20 μm.)

TABLE 3. LEG MEASUREMENTS OF MALE PARATYPE MCZ DNA101683: L = LENGTH, W = WIDTH, L/W = L/W RATIO.

Leg	Trochanter			Femur			Patella			Tibia			Metatarsus			Tarsus			Total
	L	W	L/W	L	W	L/W	L	W	L/W	L	W	L/W	Le	W	L/W	L	W	L/W	
I	0.38	0.39	0.99	1.23	0.41	2.98	0.58	0.37	1.57	0.90	0.36	2.54	0.50	0.33	1.50	0.73	0.38	1.90	4.32
II	0.32	0.39	0.83	0.86	0.40	2.16	0.53	0.39	1.36	0.71	0.45	1.57	0.53	0.37	1.44	0.71	0.44	1.59	3.66
III	0.35	0.33	1.05	0.75	0.38	1.96	0.44	0.42	1.03	0.68	0.49	1.37	0.40	0.36	1.13	0.64	0.35	1.82	3.26
IV	0.48	0.42	1.15	0.97	0.42	2.31	0.64	0.49	1.29	0.80	0.54	1.48	0.52	0.48	1.09	0.65	0.45	1.45	4.05

0.58/0.10 (5.80); 0.38/0.13 (2.92); 0.45/0.13 (3.38); 0.41/0.11 (3.80); total length: 2.21. Pedipalp trochanter without ventral process; trochanter and femur ornamented (Fig. 12C). Legs robust, with all leg segments densely ornamented (Figs. 12D–K); with a distinct solea on leg I for almost half of the length of the tarsus (Fig. 12H); claws of all legs with conspicuous lateral pegs, a distinct row of four teeth on claw II (Figs. 12H–K). Tarsus IV of males not divided (Fig. 12K); Rambla's organ absent. Adenostyle conspicuous, of the lamellar type (Fig. 12L); located at the base of the tarsus (Fig. 12K). A bulging, cup-shaped structure of unknown function is found in the ventral side toward the middle of the tarsus (Fig. 12M; Table 3).

Spermatopositor not available for study.

Description of Female. Total length of female paratype (in millimeters): 4.92; largest body width in opisthosomal segment III: 2.19 (L/W = 2.25; Fig. 10D); width across ozophores: 1.26, greatest width: 1.62. Gonostome semicircular with straight posterior margin and as long as wide (Fig. 11D). Ventral opisthosomal region without modifications and with normal ornamentation; anal plate without modifications (Fig. 11B). Tarsus of leg IV without pores or any other modification (Fig. 12N). Ovipositor not studied.

Distribution. Known only from the type locality, in the Alto Bitaco, Colombia.

Huitaca boyacaensis New Species

Figures 13–15, 29C

Type Specimens

Holotype. Male (MCZ DNA101407) near road from Arcabuco to Moniquirá (5°46′46″N, 73°27′13″W), 2,559 m, Departamento de Boyacá (Colombia), 30 October 2004, L. Benavides and G. Giribet leg.

Paratypes. Eight males, six females (MCZ DNA101407), same collecting data as holotype (one male and one female for SEM, one male and one female for DNA extraction, two males and one female dissected for genitalia).

Other Material. Five juveniles (MCZ DNA 101407), same collecting data as holotype.

Etymology. The species epithet is a noun in apposition, after Boyacá, Colombia, region from which the type specimens were collected.

Diagnosis. Large neogoveid species with an anterior opisthosomal sternal complex of the male consisting of three digit-like apophyses pointing backward, densely ornamented and with conspicuous gland openings (Fig. 14E). This sternal organ seems to be homologous to those of the other species with "M"-shaped sternal organs, *H. ventralis* and *H. tama*, the other two species with smooth walking legs tarsi, with which they form a clade. Pedipalp not ornamented (Fig. 15C); tarsus of all legs smooth (Figs. 15H–K), as in *H. ventralis* and *H. tama*; claw I with a single tooth (Fig. 15H); claw II with two teeth (Fig. 15I); claws III and IV with three (Figs. 15J, K). Accessory structure on the ventral side of male tarsus IV absent. It differs from *H. ventralis* in the spermatopositor, with the fimbriate lobes being larger than the ventral plate in *H. ventralis*, but much shorter in *H. boyacaensis*.

Description of Male. Total length of male holotype (in millimeters): 4.86; largest body

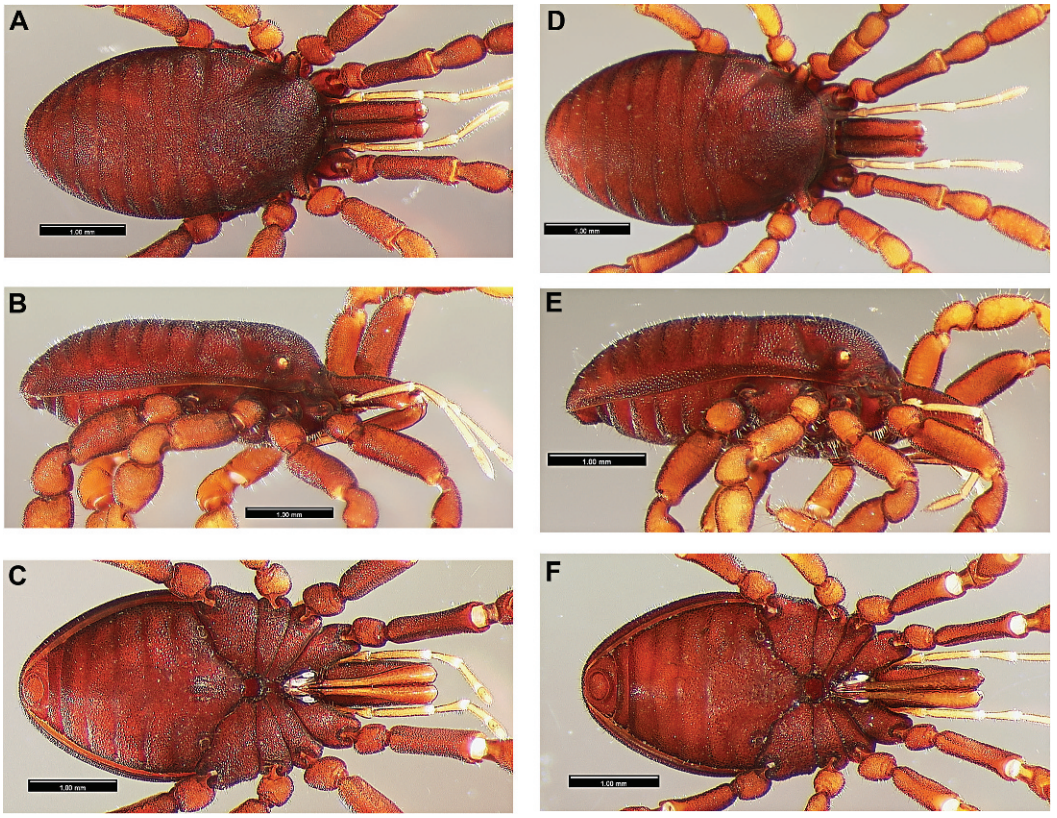

Figure 13. *Huitaca boyacaensis* new species. (A–C) Holotype male (MCZ DNA101407) in dorsal (A), ventral (B), and lateral (C) view. (D–F) Paratype female (MCZ DNA101407) in dorsal (D), ventral (E), and lateral (F) view. Scale bars 500 μm.

width in opisthosomal segment III: 1.98 (L/W: 2.45, Fig. 13A); width across ozophores: 1.16, greatest width: 1.46. Body dark brown with lighter legs (in ethanol, Figs. 13A–C). Medium-sized cyphophthalmid without eyes or eye lenses; ozophores of type 2 (*sensu* Juberthie, 1970), entirely ornamented (Fig. 14I), with subterminal ozopore. Anterior margin of carapace concave dorsally, leaving the base of the chelicerae and the dorsal crest exposed (Fig. 13A, B). Transverse prosomal sulcus inconspicuous (Fig. 13A). Transverse opisthosomal sulci present. Mid-dorsal, longitudinal opisthosomal sulcus inconspicuous (Fig. 13A).

Coxae of legs I free, coxae of legs II–IV fused (Fig. 14C). Sternum absent (Fig. 14C). Proximal end of coxae I of males not meeting along the midline; only coxae II meeting along the midline; male gonostome oblong/semicircular, delimited anteriorly by the endites of coxae III. Coxae II–III without endites running along their suture. Spiracles circular, of the closed type (Fig. 14J). Sternites 8 and 9 and tergite IX fused into a corona analis (Fig. 14H). Anal plate and anal region without conspicuous modifications or changes in ornamentation pattern. Opisthosomal sternal complex of the male consisting of three digitlike apophyses pointing backward, densely ornamented and with conspicuous gland openings (Fig. 14E). Hansen's organ absent, but a similar structure is found in the distal end of the anal plate (Fig. 14G).

Chelicerae with one dorsal and one basal process (Fig. 15A), with the proximal cheliceral segment ornamented except in the distal portion; broadest part of second

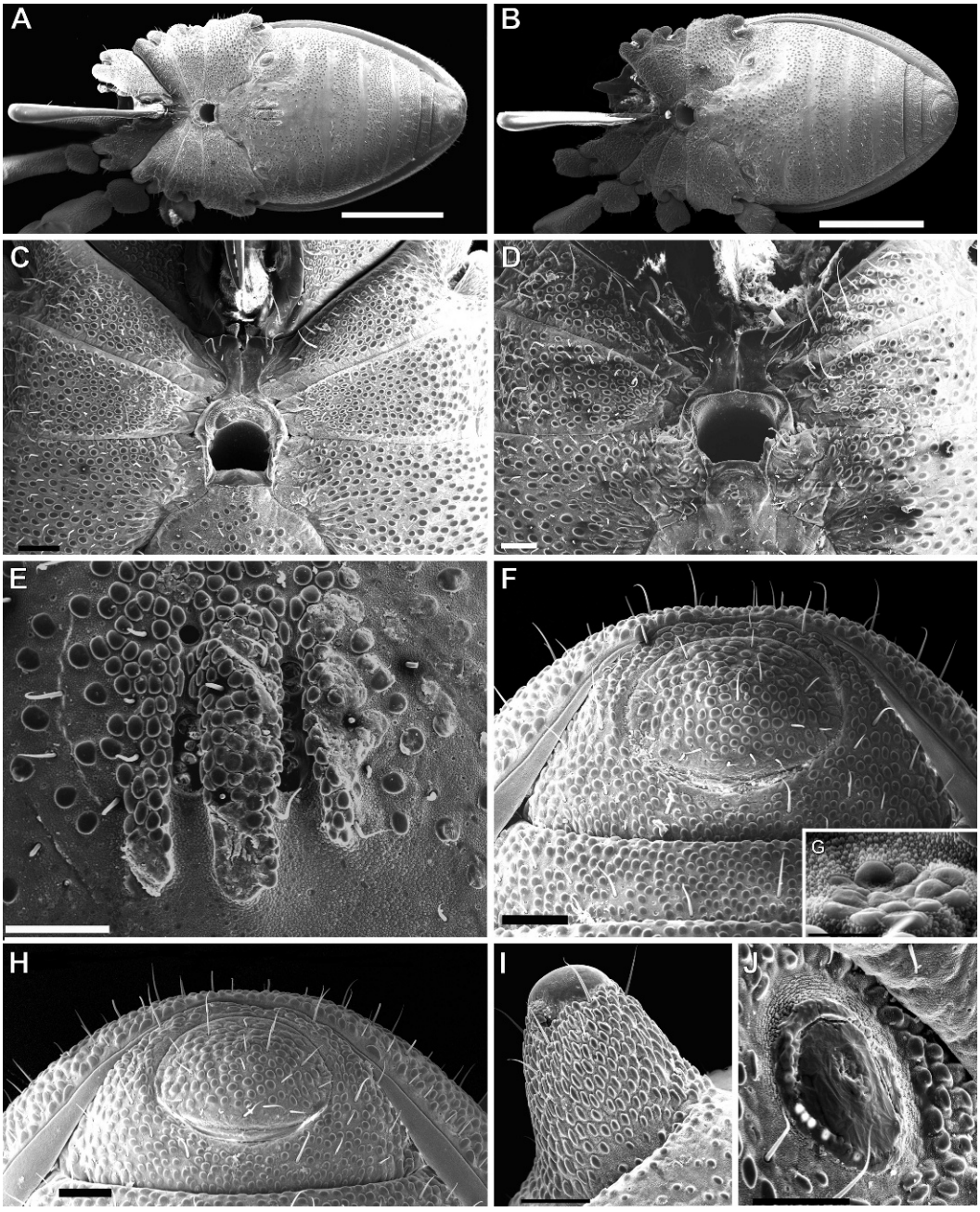

Figure 14. *Huitaca boyacaensis* new species. Paratype male and female (MCZ DNA101407). (A) Paratype male in ventral position. (B) Paratype female in ventral position. (C) Male ventral thoracic complex. (D) Female ventral thoracic complex. (E) Male exocrine glands. (F) Male anal plate. (G) Detail of the male anal plate area showing the accumulation of granules. (H) Female anal plate. (I) Male ozophore.(J) Male spiracle. (A, B, scale bars 1 mm; C–F, H–J, scale bars 100 μm; G, scale bar 10 μm.)

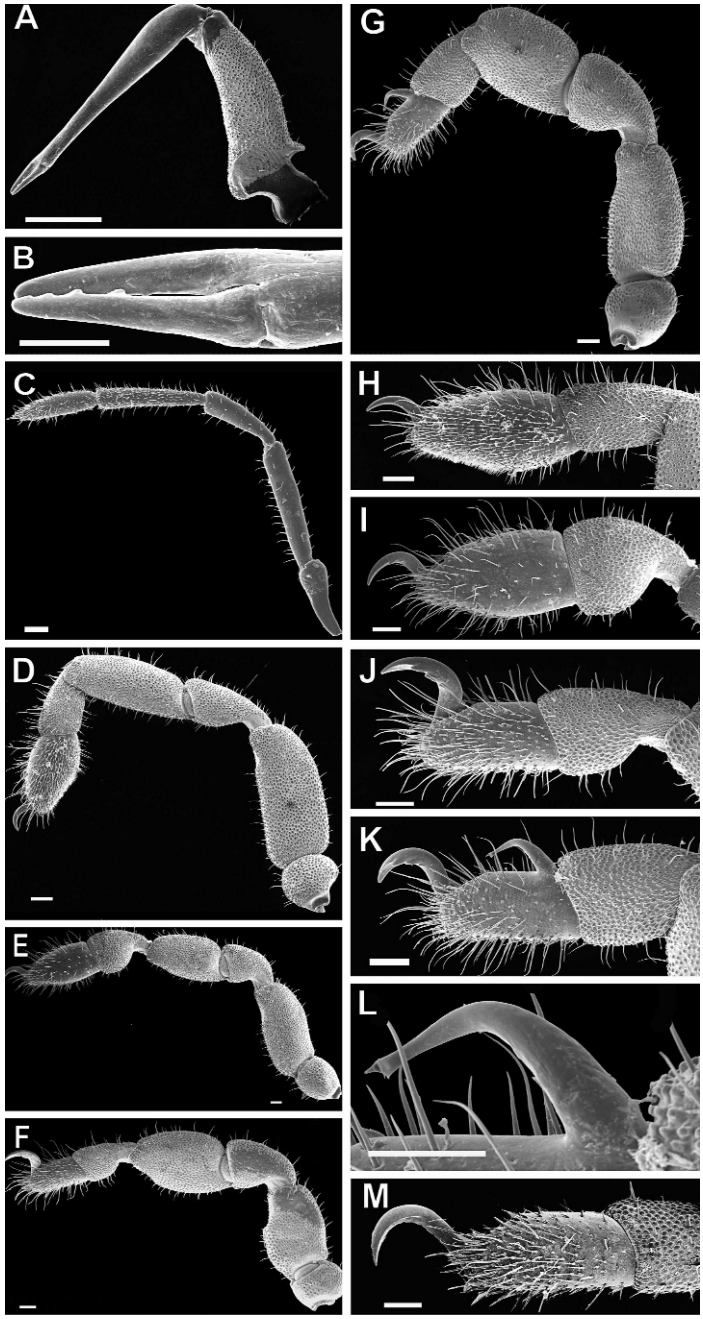

Figure 15. *Huitaca boyacaensis* new species. Paratype male and female (MCZ DNA101407). (A) Left chelicera of male. (B) Detail of the cheliceral pincer. (C) Left pedipalp of male. (D) Leg I of male. (E) Leg II of male. (F) Leg III of male. (G) Leg IV of male. (H) Metatarsus and tarsus I of male. (I) Metatarsus and tarsus II of male. (J) Metatarsus and tarsus III of male. (K) Metatarsus and tarsus IV of male. (L) Male adenostyle. (M) Metatarsus and tarsus IV of female. (A, scale bar 500 μm; B–M, scale bars 100 μm.)

TABLE 4. LEG MEASUREMENTS OF MALE PARATYPE MCZ DNA101407: L = LENGTH, W = WIDTH, L/W = L/W RATIO.

Leg	Trochanter			Femur			Patella			Tibia			Metatarsus			Tarsus			Total
	L	W	L/W	L	W	L/W	L	W	L/W	L	W	L/W	Le	W	L/W	L	W	L/W	
I	0.35	0.37	0.95	1.01	0.42	2.43	0.66	0.34	1.95	0.79	0.35	2.29	0.49	0.27	1.83	0.60	0.33	1.78	3.90
II	0.44	0.37	1.19	0.81	0.40	2.03	0.56	0.38	1.49	0.63	0.40	1.58	0.58	0.37	1.55	0.59	0.35	1.70	3.62
III	0.43	0.40	1.07	0.61	0.42	1.47	0.47	0.40	1.16	0.66	0.46	1.43	0.45	0.26	1.76	0.35	0.21	1.69	2.97
IV	0.43	0.46	0.92	0.85	0.49	1.73	0.61	0.45	1.37	0.62	0.51	1.22	0.53	0.36	1.50	0.44	0.24	1.88	3.48

cheliceral segment near the proximal end (Fig. 15A); dentition of mobile digit with bicuspidate teeth in the mobile digit, and alternation of large and small nodular teeth in the fixed digit (*sensu* de Bivort and Giribet, 2004) (Fig. 15B). Pedipalp measurements of male paratype (length/width; L/W ratio in parentheses): 0.39/0.13 (3.03); 0.63/0.11 (5.84); 0.43/0.12 (3.59); 0.57/0.11 (5.18); 0.38/0.30 (1.30); total length: 2.41. Pedipalp trochanter without ventral process; trochanter and femur ornamented (Fig. 15C). Legs robust, with all leg segments except the tarsus densely ornamented (Figs. 15D–G); tarsus of all legs smooth (Figs. 15H–K), with a distinct solea on leg I for almost half of the length of the tarsus (Fig. 15H); claws of all legs with conspicuous lateral pegs; claw I with a single tooth (Fig. 15H); claw II with two teeth (Fig. 15I); claws III and IV with three (Figs. 15J, K). Tarsus IV of males not divided (Fig. 15K); Rambla's organ absent. Adenostyle conspicuous, of the lamellar type (Figs. 15K, L); located at the base of the tarsus (Fig. 15K). Accessory structure on the ventral side of male tarsus IV absent (Table 4).

Spermatopositor (Fig. 29C) with a series of eigth to nine lateral microtrichiae on each side, shorter than the ventral plate, fringed distally by a series of very short microtrichiae, six on each side. Dorsal side with two largely fimbriate lobes, shorter than the ventral plate.

Description of Female: Total length of female paratype (in millimeters) 4.59; largest body width in third opisthosomal segment: 2.01 (L/W = 2.28; Fig. 13D); width across ozophores: 1.18, greatest width: maximum width 1.44. Ovipositor not studied.

Distribution. Known only from the type locality in the Departamento de Boyacá, Colombia.

Huitaca caldas New Species

Figures 16–18, 29D

Type Specimens

Holotype. Male (MCZ DNA101681) from Vereda El Paraíso (5°05′58.4″N, 75°24′21.4″W), 3,055 m, Manizales, Departamento de Caldas (Colombia), 6 February 2004, L. Franco leg.

Paratypes. Seven males, three females (MCZ DNA 101681), same collecting data as holotype (one male, one female for SEM; one male for DNA extraction; one male, one female dissected for genitalia).

Etymology. The species epithet is a noun in apposition, after the Departmento de Caldas, Colombia.

Diagnosis. Neogoveid with coxae II and III endites with processes running along their suture (Fig. 17B). Male secretory gland triangular, with two gland pores opening in the second opisthosomal sternite (Figs. 17A, C) and with a distinct ventral depression along the midline of the opisthosomal sternites 2–5, widest and deepest between sternites 3 and 5, and with a fine granulation (Figs. 17A–H). The new species shares with *H. bitaco* and *H. boyacaensis* the cuticular Hansen's organlike structure (Fig. 17H). Pedipalp trochanter and femur sparsely ornamented (Fig. 18C). Tarsus of all legs ornamented (Figs. 18H–K, N); metatarsus of legs II–IV distinctly swollen.

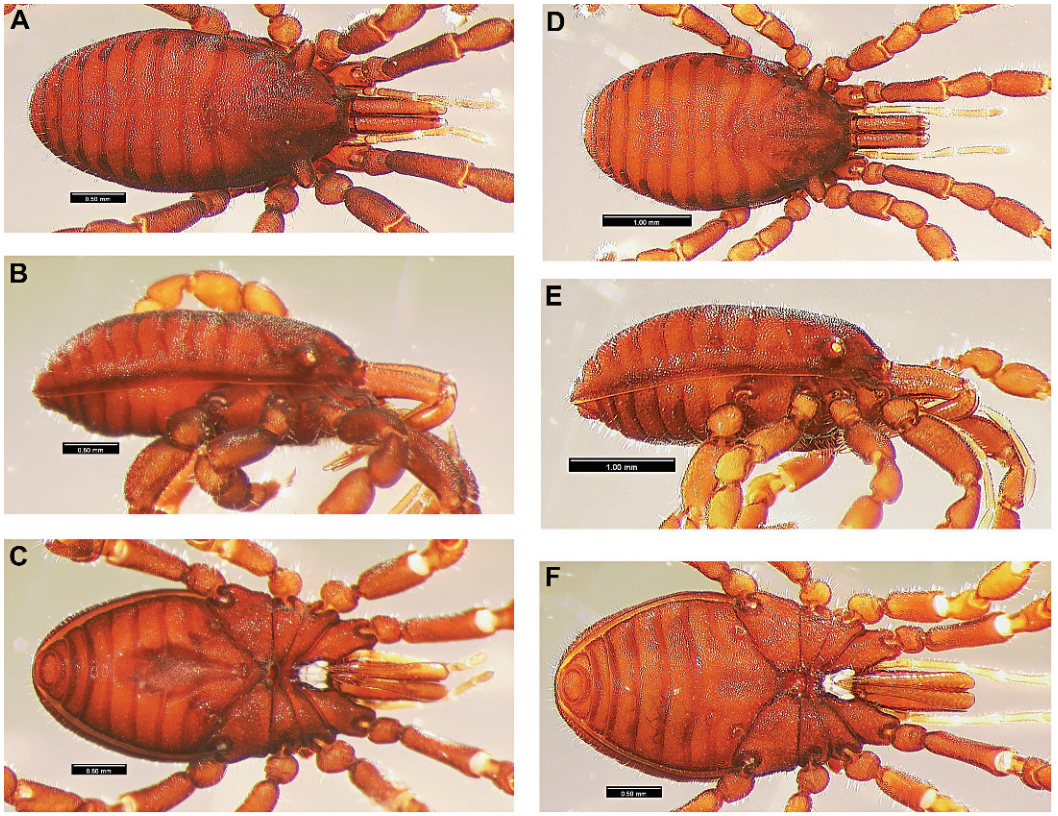

Figure 16. *Huitaca caldas* new species. (A–C) Holotype male (MCZ DNA101681) in dorsal (A), ventral (B), and lateral (C) view. (D–F) Paratype female (MCZ DNA101681) in dorsal (D), ventral (E), and lateral (F) view. Scale bars 500 μm.

Leg I with a distinct solea and a claw with a single tooth (Fig. 18H). Claw II with six teeth in a row in its retrolateral margin and two in the prolateral margin (Fig. 18I). Claws III and IV with three teeth in its retrolateral margin and no teeth in the prolateral margin (Figs. 18J, K). Cuticular structure on the ventral side of male tarsus IV bowl-shaped and with a pore opening (Fig. 18M). Spermatopositor most similar to that of *H. ventralis* from which *H. caldas* can be easily distinguished by the opisthosomal sternal organ.

Description of Male. Total length of male holotype (in millimeters): 3.93; largest body width in opisthosomal segments III–IV: 1.55 (L/W ratio: 2.53); width across ozophores: 0.89, greatest width: 1.14; body and legs light orange (in ethanol, Figs. 16A–C). Pedipalp measurements of male paratype in millimeters; L/W ratio: 0.38/0.13 (2.98); 0.51/0.10 (4.98); 0.31/0.09 (3.41); 0.47/0.10 (4.83); 0.22/0.07 (3.21); total length: 1.89. Hansen's organ absent, but a similar structure is found in the distal end of the anal plate (Fig. 17H; Table 5).

Spermatopositor (Fig. 29D) with an elongated ventral plate with two groups of three spinelike microtrichiae, a median lobe with four digitiform microtrichiae, and a ventral cuticular fold triangular in shape with an apical thick microtrichia and fringed by one group of four long microtrichiae in each side, and four also in the dorsal side. Two fimbriate lobes, almost surpassing the ventral plate, are present in the interior of the dorsal side around the gonopore.

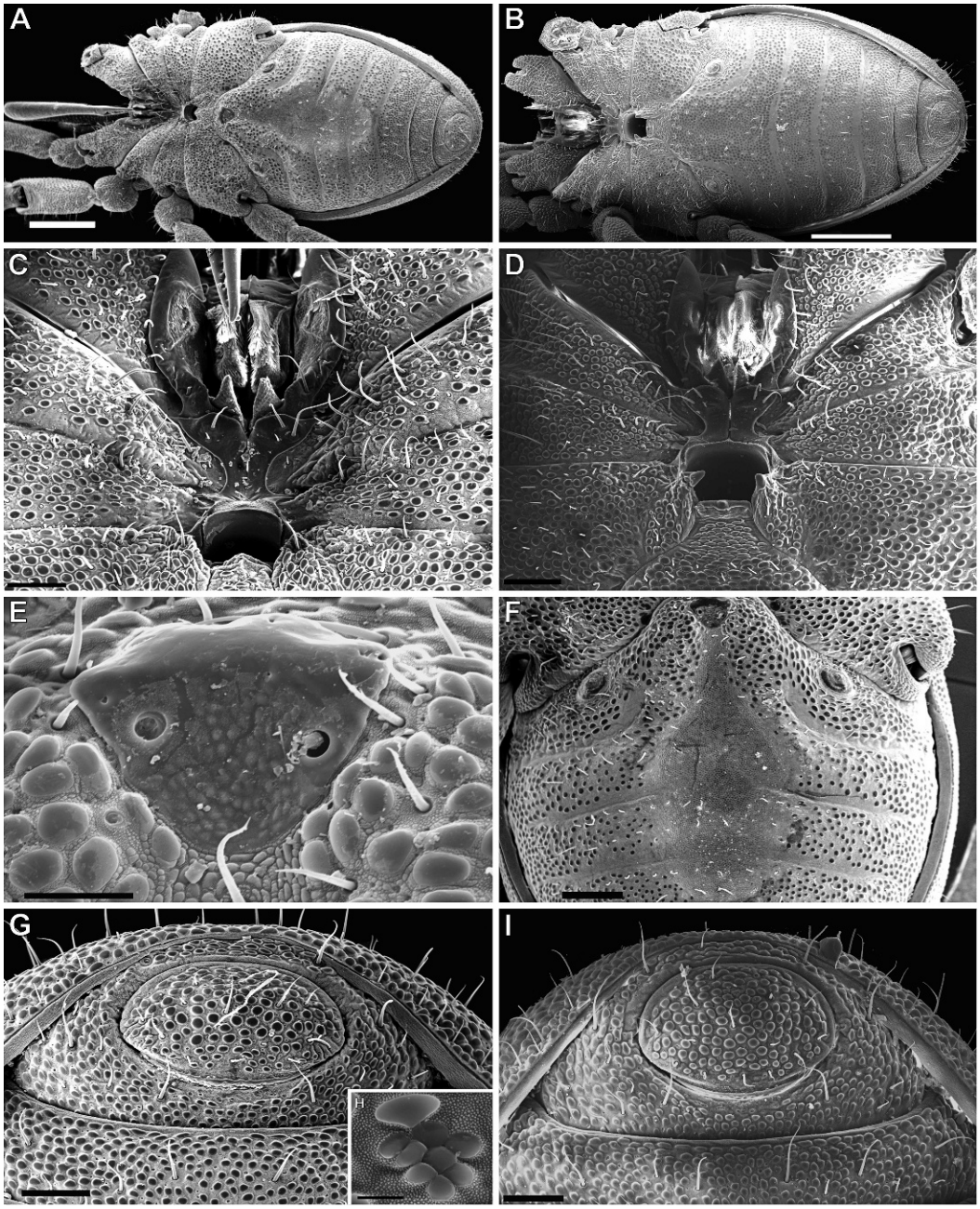

Figure 17. *Huitaca caldas* new species. Paratype male and female (MCZ DNA101681). (A) Paratype male in ventral position. (B) Paratype female in ventral position. (C) Male ventral thoracic complex. (D) Female ventral thoracic complex. (E) Male sternal complex with a detail of the exocrine gland. (F) Male sternal complex showing the depression along sternites 2–4. (G) Male anal plate. (I) Detail of the male anal plate area showing the accumulation of granules. (J) Female anal plate. (A, B, scale bars 500 μm; C, D, G, I, scale bars 100 μm; E, scale bar 50 μm; F, scale bar 200 μm; H, scale bar 10 μm.)

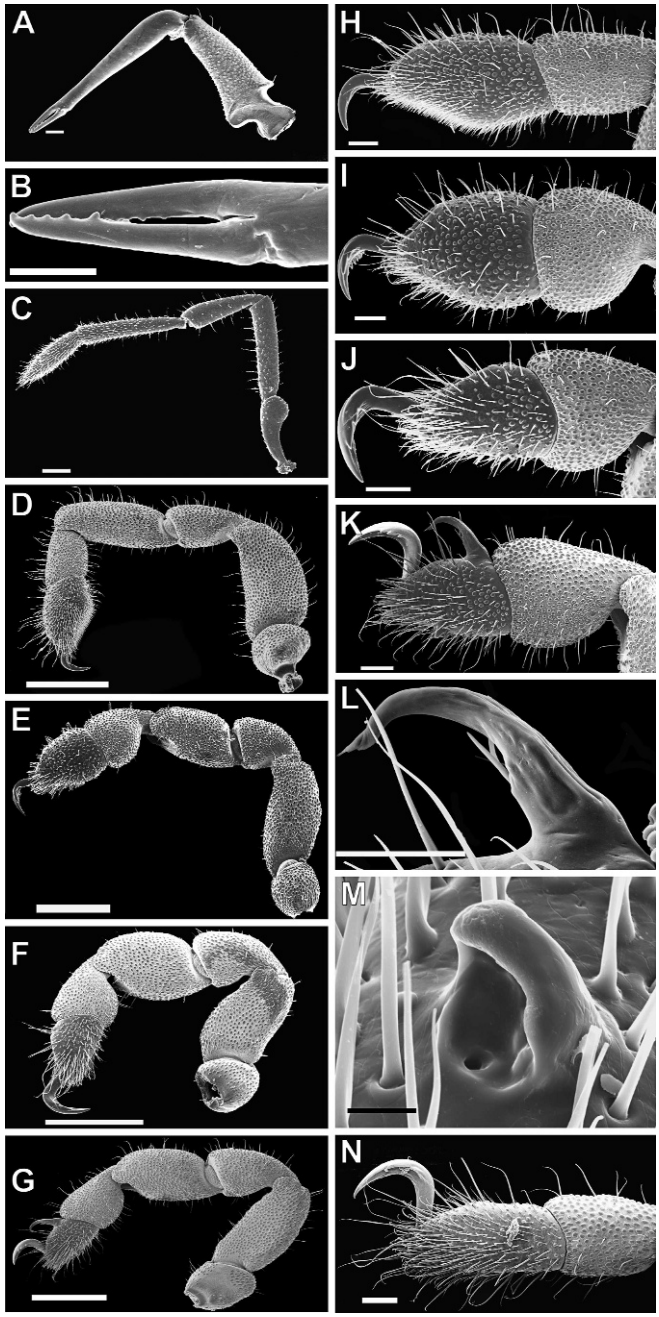

Figure 18. *Huitaca caldas* new species. Paratype male and female (MCZ DNA101681). (A) Left chelicera of male. (B) Detail of the cheliceral pincer. (C) Left pedipalp of male. (D) Leg I of male. (E) Leg II of male. (F) Leg III of male. (G) Leg IV of male. (H) Metatarsus and tarsus I of male. (I) Metatarsus and tarsus II of male. (J) Metatarsus and tarsus III of male. (K) Metatarsus and tarsus IV of male. (L) Male adenostyle. (M) Detail of the structure in the ventral side of male tarsus IV. (N) Metatarsus and tarsus IV of female. (A–C, H–L, N, scale bars 100 μm; D–G, scale bars 500 μm; M, scale bar 20 μm.)

TABLE 5. LEG MEASUREMENTS OF MALE PARATYPE MCZ DNA 101681: L = LENGTH, W = WIDTH, L/W = L/W RATIO.

	Trochanter			Femur			Patella			Tibia			Metatarsus			Tarsus			
Leg	L	W	L/W	L	W	L/W	L	W	L/W	L	W	L/W	Le	W	L/W	L	W	L/W	Total
I	0.34	0.35	0.98	0.71	0.38	1.88	0.48	0.30	1.61	0.65	0.29	2.25	0.38	0.25	1.51	0.48	0.29	1.67	3.04
II	0.32	0.30	1.05	0.64	0.38	1.71	0.40	0.32	1.25	0.54	0.31	1.74	0.42	0.37	1.14	0.48	0.34	1.41	2.79
III	0.33	0.32	1.03.	0.59	0.35	1.68	0.42	0.32	1.31	0.50	0.40	1.25	0.32	0.34	0.94	0.35	0.27	1.29	2.50
IV	0.38	0.27	1.41	0.73	0.35	2.09	0.43	0.33	1.30	0.61	0.40	1.53	0.45	0.33	1.38	0.38	0.24	1.60	2.98

Description of Female. Total length of female paratype (in millimeters): 3.89; maximum body width in opisthosomal segments III-IV: 1.62 (L/W = 2.40; Figs. 16D–F); width across ozophores: 0.92, greatest width: 1.18. Ovipositor not studied.

Distribution. Known only from the type locality in the Departamento de Caldas, Colombia.

Huitaca depressa New Species

Figures 19–22, 29E

Type Specimens

Holotype. Male (MCZ DNA102150) from Parque Nacional Natural Tatamá (5°09′29″N, 76°01′00″W), 2,300 m, Municipio de Apía, Departamento de Risaralda (Colombia). Winkler trap #22, forest; 26–28 August 2004. A. Pulido & E. González leg.

Paratypes. Twelve males, 18 females (MCZ DNA102150), same collecting data as the holotype (one male, one female used for SEM; one male used for DNA extraction; one male, one female dissected for genitalia).

Other Material. Two juveniles (MCZ DNA102150), same collecting data as the holotype.

Etymology. The species epithet refers to the conspicuous ventral depression along the midline of the opisthosoma in males

Diagnosis. Males of *H. depressa* are easily distinguished by the long, deep depression of the opisthosomal sternites 2–5, with two pores in the anterior end of the depression (Figs. 20A, C, F). This depression presents a microgranulation and has a middle longitudinal ridge along sternites 4 and 5 (Figs. 20A, E). Metatarsus and tarsus of all walking legs conspicuously ornamented (Figs. 22D–K). Adenostyle lamelliform and located toward the base of the dorsal side of tarsus IV (Fig. 22L). Accessory cuticular structure on the ventral side of male tarsus IV tubular (Fig. 22M), but in the same position of that in *H. bitaco*, *H. caldas*, and *H. sharkeyi*. The female can be distinguished from any other species by the presence of the two lateral depressions of the corona analis (Figs. 21B–D).

Description of Male. Total length of male holotype (in millimeters):4.30; largest body width in opisthosomal segment III: 1.89 (L/W ratio: 2.27); width across ozophores: 1.14, greatest width: 1.42; body dark orange and legs light orange (in ethanol, Figs. 19A–C). Pedipalp measurements of male paratype in millimeters; length/width (L/W ratio): 0.36/0.10 (3.6); 0.52/0.09 (5.78); 0.34/0.11 (3.09); 0.48/0.09 (5.33); 0.33/0.08 (4.12); total length: 2.03 (Table 6).

Spermatopositor (Fig. 29E) with ventral plate elongated, with a group of three spinelike microtrichiae on each distal side. Dorsal plate triangular with three long apical microtrichiae, and a series of seven to nine microtrichiae on each side. The median plate is slightly longer than the ventral plate, with two bifurcated short microtrichiae. Two fimbriate lobes, shorter than the ventral plate, are present in the interior of the dorsal side around the gonopore.

Description of Female. Total length of female paratype (in millimeters): 4.27; largest body width in opisthosomal segment III: 1.89 (L/W ratio: 2.26); width across

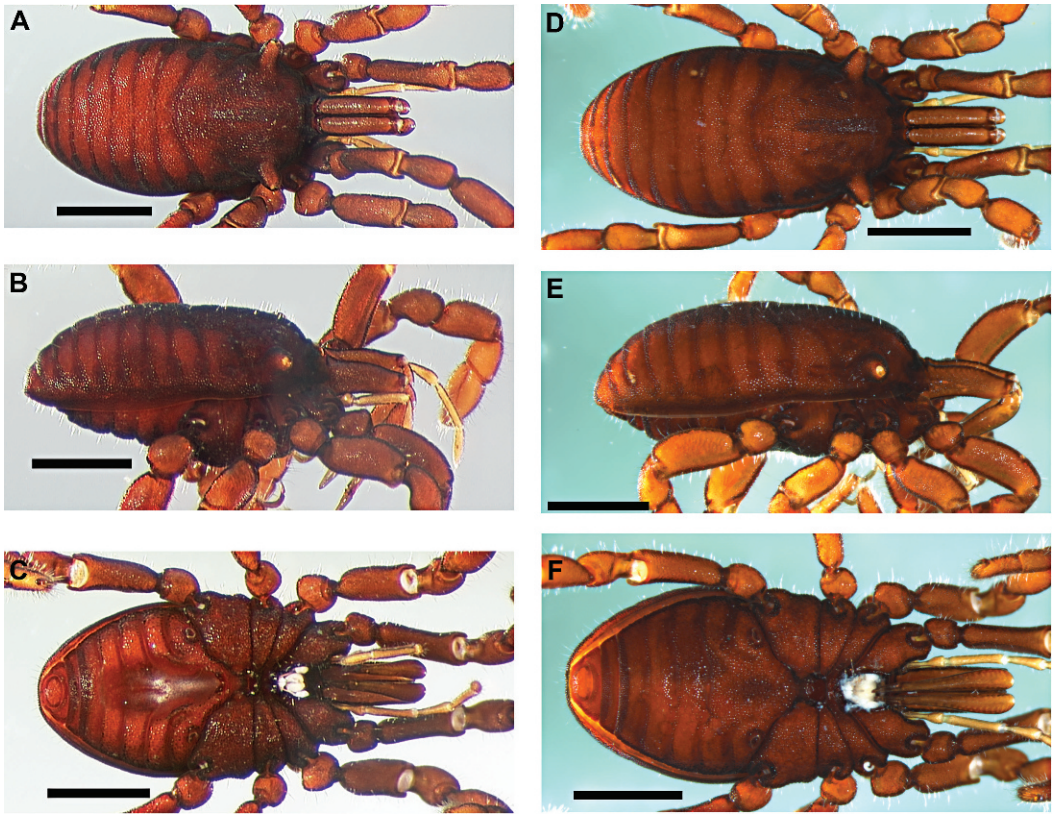

Figure 19. *Huitaca depressa* new species. (A–C) Holotype male (MCZ DNA102150) in dorsal (A), ventral (B), and lateral (C) view. (D–F) Paratype female (MCZ DNA102150) in dorsal (D), ventral (E), and lateral (F) view. Scale bars 500 μm.

ozophores: 1.14; greatest width: 1.42 (Figs. 19D–F). The corona analis shows two lateral depressions that show a microtuberculate sculpture and a possible glandular cuticular structure (Figs. 21B–D).

Distribution. Known only from the type locality in the Departamento de Risaralda, Colombia.

Huitaca sharkeyi New Species

Figures 23–25, 29F

Type Specimens

Holotype. Male (MCZ DNA104646) from Finca Montebello, Alto Bitaco (03°33′30″N, 76°34′58″W), 2,030 m, La Cumbre, Corregimiento Bitaco, Vereda Chicoral, Alto Bitaco, Departamento del Valle del Cauca (Colombia); human dung trap #48; 29–31 July 2003, I. Quintero & E. González leg.

Paratypes. Three males, one female (MCZ DNA104646), same collecting data as the holotype (one male for SEM, one male for DNA extraction, one male dissected for genitalia).

Etymology. The species is named after Professor Michael Sharkey, whose diligent arthropod surveys in Colombia generated the material for this and other species.

Diagnosis. Globose species of neogoveid (Fig. 23B) with a narrow posterior end and small anal plate (Figs. 24A, H). Gonostome narrow (Figs. 24A, B). Sternal opisthosomal glandular complex opening behind gonostome (Fig. 24B); the sternal complex is composed by a broad, oblong, subacute

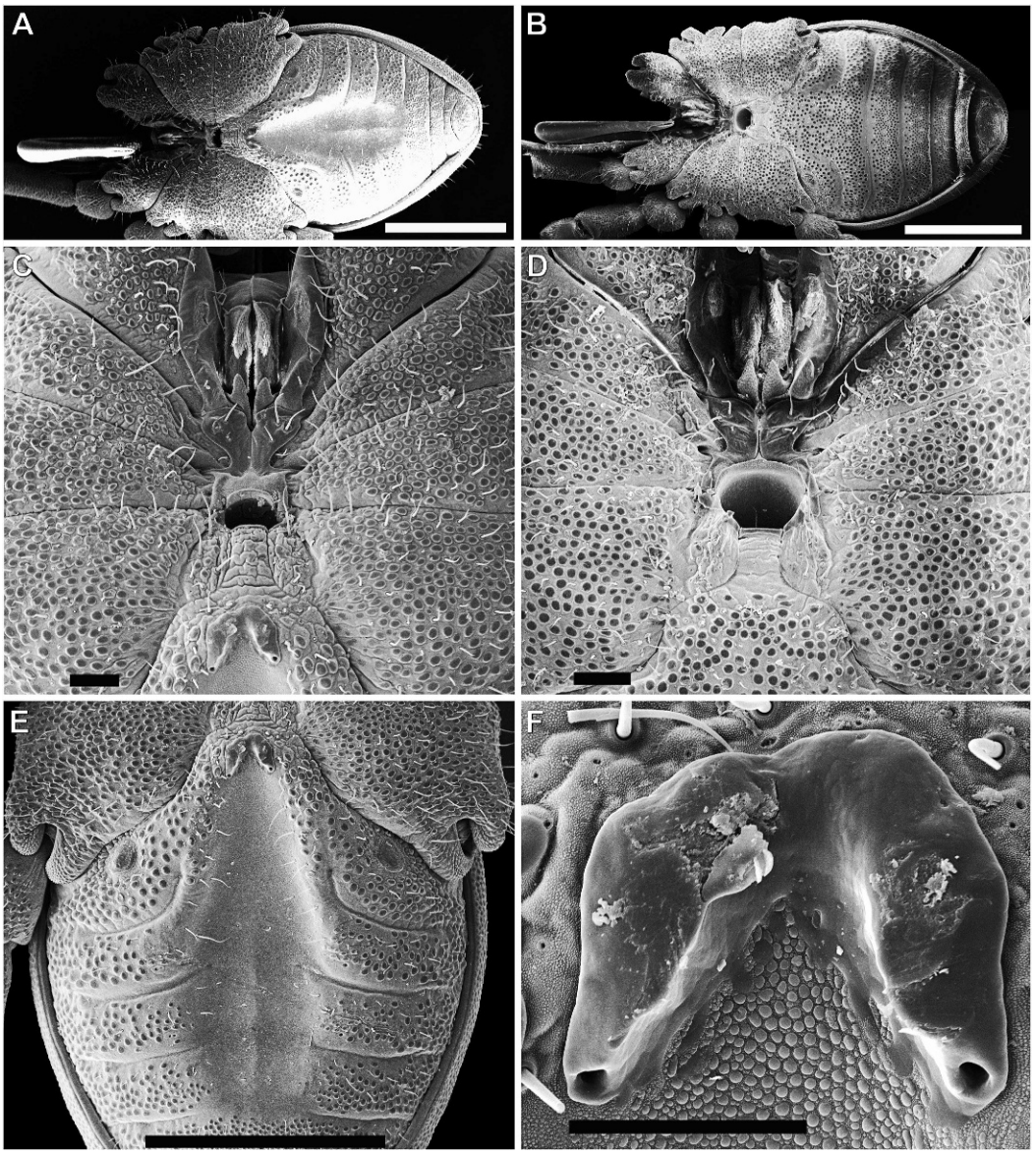

Figure 20. *Huitaca depressa* new species. Paratype male and female (MCZ DNA102150). (A) Paratype male in ventral position. (B) Paratype female in ventral position. (C) Male ventral thoracic complex. (D) Female ventral thoracic complex. (E) Male sternal complex showing the depression along sternites 1–4. (F) Male sternal complex with a detail of the exocrine gland. (A, B, scale bars 1 mm; C, D, scale bars 100 μm; E, scale bar 500 μm; F, scale bar 200 μm.)

process directed downward and backward (Figs. 24F, G), very similar to that of its sympatric species *H. bitaco*. The process bears a few setae, a single large pore opening, and several micropores (Figs. 24F, G). A sternal depression without ornamentation extends along segments 2–5, becoming biconcave along segments 3–5 (Figs. 24A, C). Anal plate small, without conspicuous modifications (Fig. 24H). Tarsus of all legs ornamented (Figs. 24D–G); leg I with a distinct solea and a claw with a single narrow

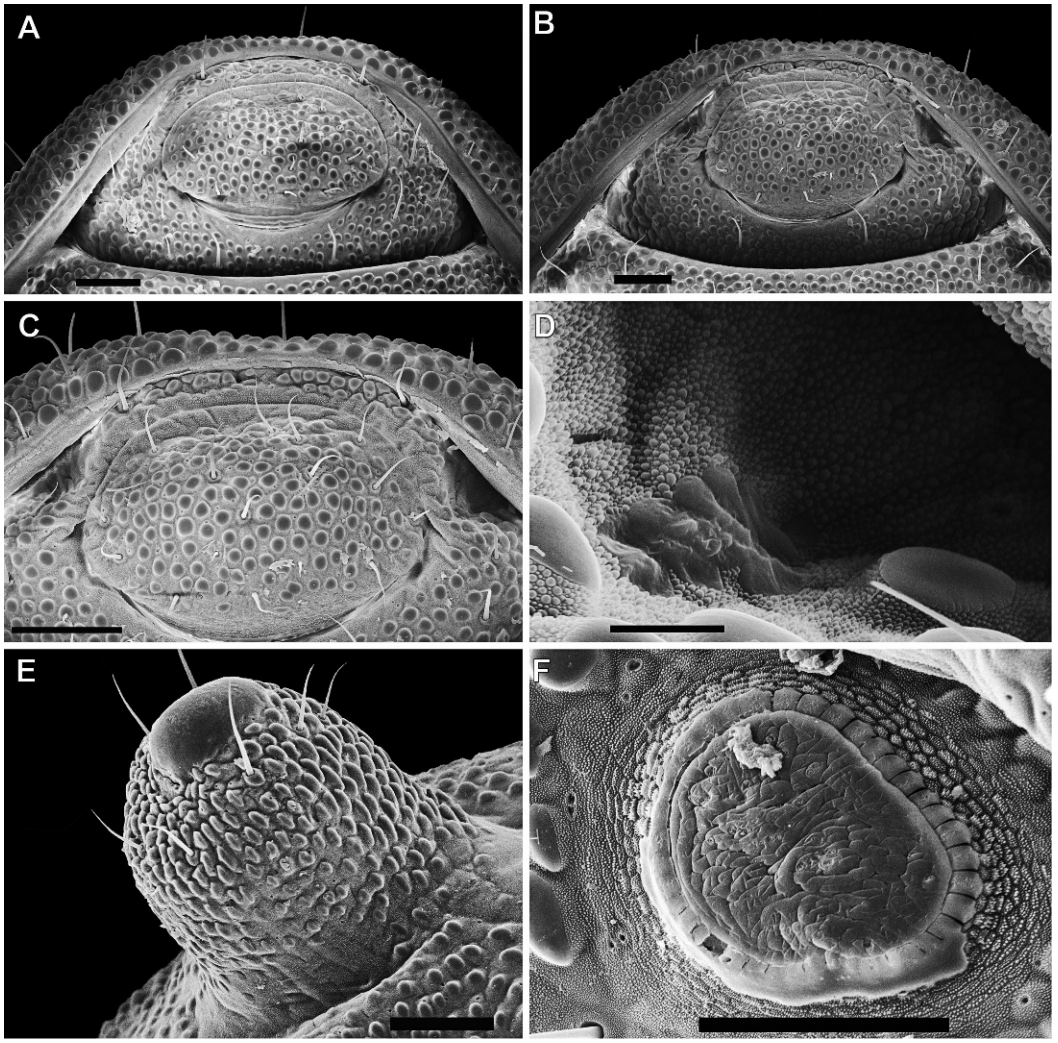

Figure 21. *Huitaca depressa* new species. Paratype male and female (MCZ DNA102150). (A) Male anal plate. (B) Female anal plate. (C) Detail of the female anal plate area showing the two depressions along each side on the distal end of the anal plate. (D) Detail of the depression showing the micro-ornamentation and a possible glandular organ. (E) Male ozophore. (F) Male spiracle. (A–C, E, F, scale bars 100 μm; D, scale bar 10 μm.)

tooth (Fig. 24H). Claw II with eight teeth in a row in its retrolateral margin (Fig. 24I). Claws III and IV with two teeth in its retrolateral margin and no teeth in the prolateral margin (Figs. 24J, K). Accessory cuticular structure on the ventral side of male tarsus IV small and digitiform (Figs. 24K, L). This species is closely related to a sympatric larger species, *H. bitaco*, although they differ in the accessory organ of the tarsus IV of males and in the more elongated shape of this species.

Description of Male. Total length of male holotype (in mllimeters): 4.64; largest body width in opisthosomal segment III: 1.96; width across ozophores: 1.25; greatest width: 1.54; L/W ratio: 2.36; body dark orange and legs light orange (in ethanol, Figs. 23A–C). Pedipalp measurements of male paratype; length/width (L/W ratio): 0.22/0.07 (3.14); 0.32/0.06

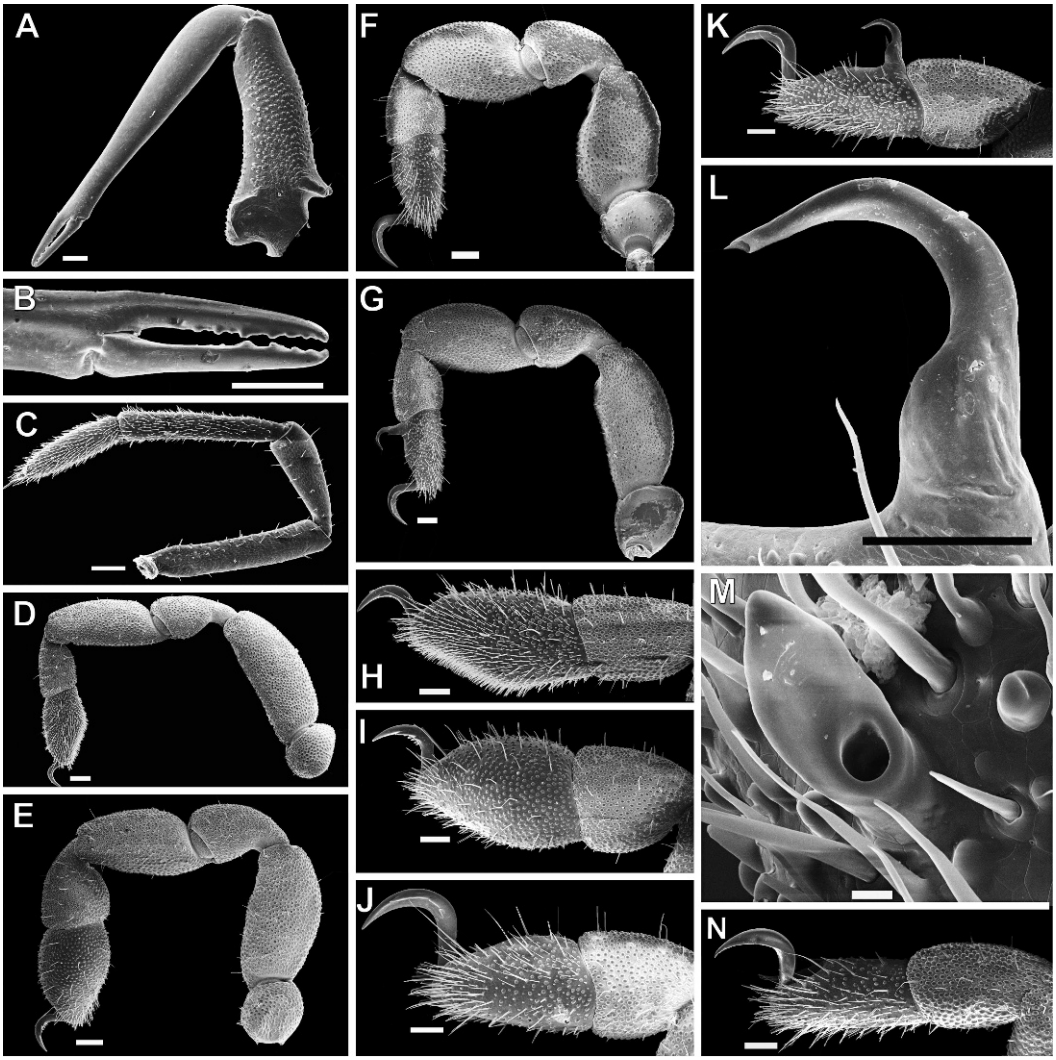

Figure 22. *Huitaca depressa* new species. Paratype male and female (MCZ DNA102150). (A) Left chelicera of male. (B) Detail of the cheliceral pincer. (C) Left pedipalp of male. (D) Leg I of male. (E) Leg II of male. (F) Leg III of male. (G) Leg IV of male. (H) Metatarsus and tarsus I of male. (I) Metatarsus and tarsus II of male. (J) Metatarsus and tarsus III of male. (K) Metatarsus and tarsus IV of male. (L) Male adenostyle. (M) Detail of the structure in the ventral side of male tarsus IV. (N) Metatarsus and tarsus IV of female. (A–C, H–L, N, scale bars 100 μm; D–G, scale bars 200 μm; M, scale bar 10 μm.)

(5.33); 0.22/0.07 (3.14); 0.28/0.06 (4.67); 0.19/0.05 (3.8); total length: 1.23 (Table 7).

Spermatopositor (Fig. 29F), with a long ventral plate with terminal short microtrichiae and a series of long microtrichiae along the triangular dorsal plate. Structures around the gonostome not well preserved.

Description of Female. Total length of female paratype (in millimeters): 4.53; maximum width in opisthosomal segment III: 2.01(L/W = 2.86; Figs. 23 D–F); width across ozophores: 1.20, greatest width: 1.50. Female paratype not studied under SEM. Ovipositor not studied.

TABLE 6. LEG MEASUREMENTS OF MALE PARATYPE MCZ DNA102150: L = LENGTH, W = WIDTH, L/W = L/W RATIO.

	Trochanter			Femur			Patella			Tibia			Metatarsus			Tarsus			
Leg	L	W	L/W	L	W	L/W	L	W	L/W	L	W	L/W	L	W	L/W	L	W	L/W	Total
I	0.37	0.51	1.82	1.18	0.53	2.22	0.73	0.40	1.83	1.03	0.41	2.5	0.58	0.35	1.65	0.62	0.41	1.51	4.51
II	0.43	0.47	0.91	0.97	0.55	1.76	0.63	0.43	1.46	0.86	0.47	1.82	0.64	0.49	1.3	0.71	0.53	1.33	4.24
III	0.40	0.55	0.89	0.91	0.62	1.46	0.58	0.48	1.21	0.87	0.56	1.55	0.56	0.44	1.27	0.66	0.39	1.69	3.98
IV	0.57	0.55	1.03	1.35	0.60	2.25	0.75	0.52	1.44	1.01	0.55	1.83	0.57	0.40	1.16	0.68	0.30	2.26	4.93

Distribution. Known only from the type locality in the Alto Bitaco of Colombia.

***Huitaca tama* New Species**

Figures 26–28, 29G

Type Specimens

Holotype. Male (MCZ DNA 101671) from Alto de La Herrera (7°25′N, 72°26′W), 1,000 m, Vereda El Diamante, Parque Nacional Natural Tamá, Departamento de Norte de Santander (Colombia), 30 September 1999, E. González leg.

Paratypes. Fifteen males and five females (MCZ DNA101673, DNA101675), same collecting data as holotype (one male and one female for SEM, one male and one female for DNA extraction, two males and one female dissected for genitalia); eight

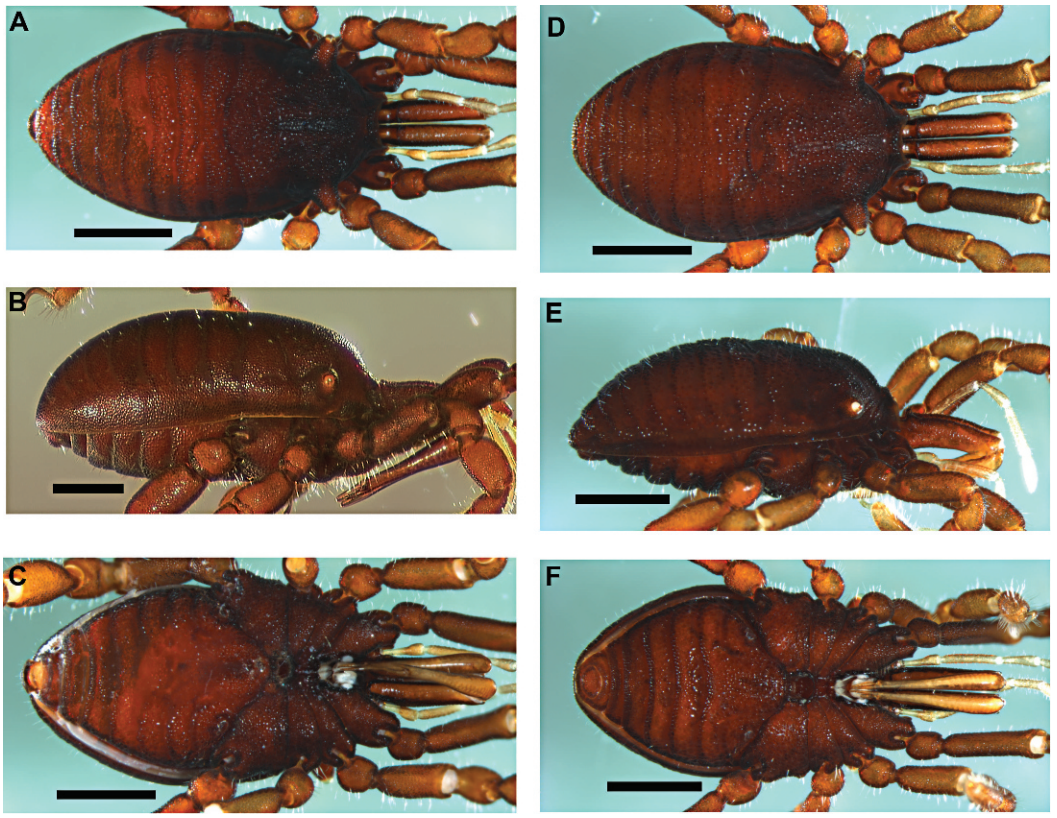

Figure 23. *Huitaca sharkeyi* new species. (A–C) Holotype male (MCZ DNA104646) in dorsal (A), ventral (B), and lateral (C) view. (D–F) Paratype female (MCZ DNA104646) in dorsal (D), ventral (E), and lateral (F) view. Scale bars 500 μm.

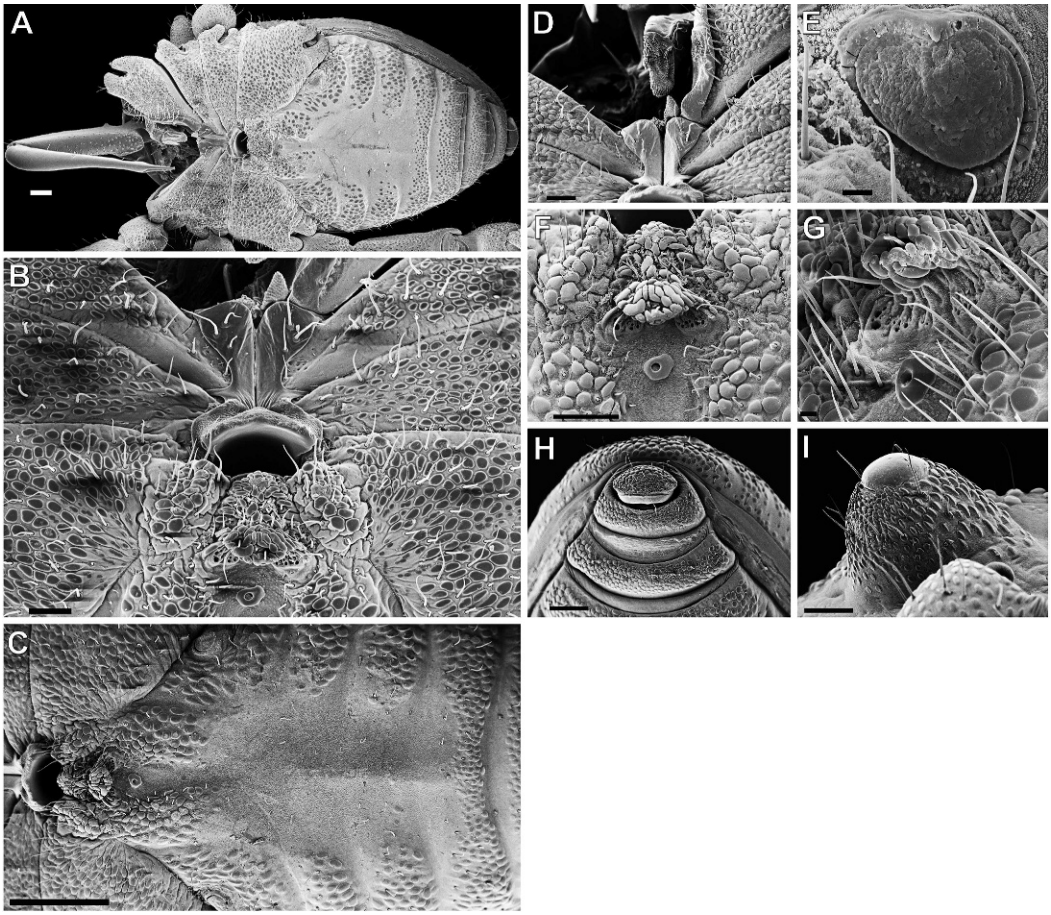

Figure 24. *Huitaca sharkeyi* new species. Paratype male (MCZ DNA104646). (A) Paratype male in ventral position. (B) Male ventral thoracic complex. (C) Male sternal complex showing the depression along sternites 1–4. (D) Detail of male ventral anterior area showing the oral lappet. (E) Male spiracle. (F) Male sternal complex with a detail of the exocrine gland in ventral view. (G) Same in lateral view. (H) Male anal plate. (I) Male ozophore. (A, scale bars 200 μm; B, D–F, H, I, scale bars 100 μm; C, scale bar 500 μm; G, scale bar 20 μm.)

males and five females (MCZ DNA101672) from Sendero Binacional (7°25′N, 72°26′W), 2,470 m, Parque Nacional Natural Tamá, Departamento de Norte de Santander (Colombia), 1 September 1999, A. Cortes leg.

Etymology. The species epithet is a noun in apposition after Tamá, Colombia, name of the National Park where the type specimens were collected.

Diagnosis. This species is similar to its smaller sister species *Huitaca ventralis*, with a similar sternal opisthosomal glandular organ (Figs. 27C, F), placed right behind a thin posterior end of the gonostome wall, with a trilobed aspect (Fig. 27E); this gonostome and sternal opisthosomal organ distinguishes this from all other species other than *H. ventralis.* The unornamented tarsi (Figs. 28C–K) is found in another member of its clade, *H. boyacaensis* and *H. ventralis*. Leg I with a distinct solea and a smooth claw (Fig. 28H), as in *H. ventralis*; claw II with five teeth in a row in its prolateral margin and one tooth in its retrolateral margin (Fig. 28I). Claw III

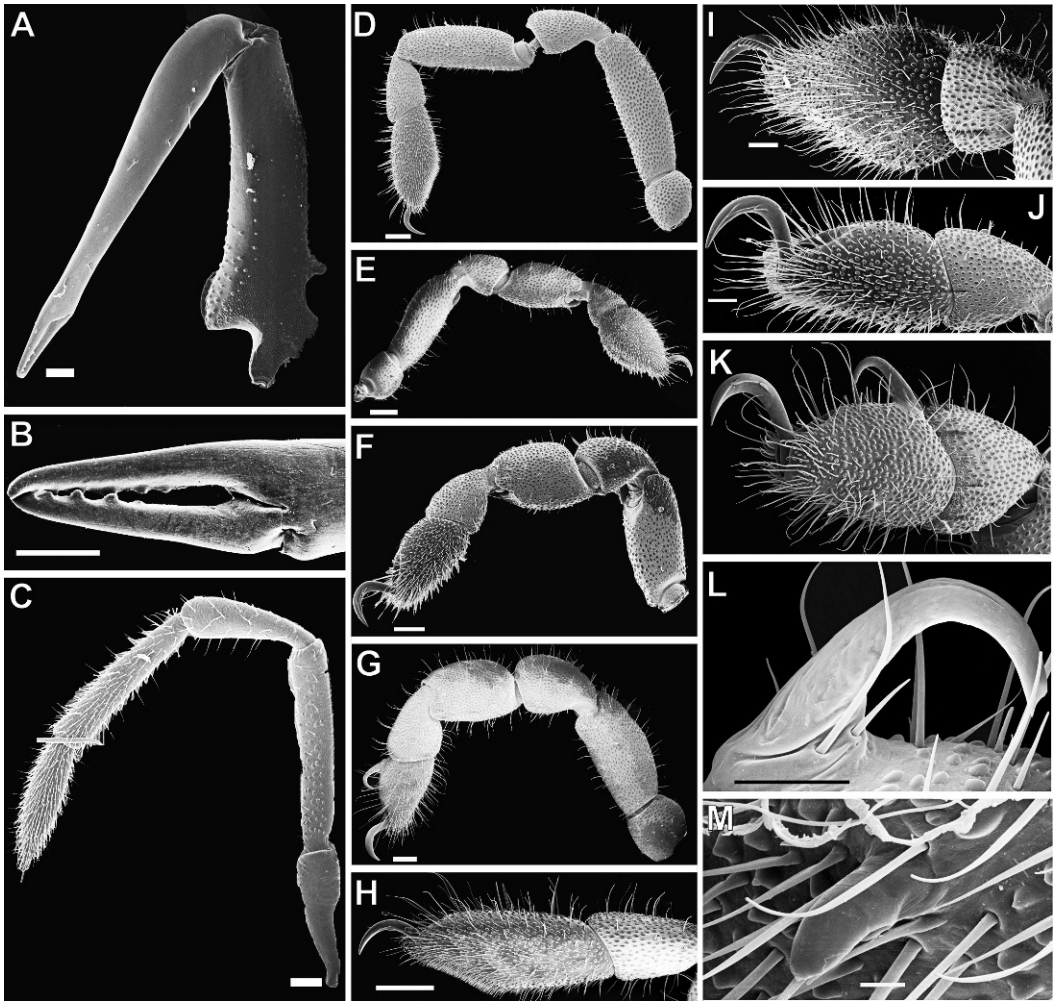

Figure 25. *Huitaca sharkeyi* new species. Paratype male (MCZ DNA104646). (A) Left chelicera of male. (B) Detail of the cheliceral pincer. (C) Left pedipalp of male. (D) Leg I of male. (E) Leg II of male. (F) Leg III of male. (G) Leg IV of male. (H) Metatarsus and tarsus I of male. (I) Metatarsus and tarsus II of male. (J) Metatarsus and tarsus III of male. (K) Metatarsus and tarsus IV of male. (L) Male adenostyle. (M) Detail of the structure in the ventral side of male tarsus IV. (A–C, H–L, scale bars 100 μm; D–G, scale bars 200 μm; M, scale bar 20 μm.)

modified with one tooth in its retrolateral margin and no teeth in the prolateral margin (Figs. 28J). Claw IV without teeth. No accessory cuticular structure is found on the ventral side of male tarsus IV, as opposed to the species with ornamented tarsi, which present the modifications.

Description of Male. Total length of male holotype (in millimeters): 4.16, largest body width behind ozophores: 1.67 (L/W ratio: 2.49); width across ozophores: 1.00, greatest width: 1.21; body medium brown, legs light brown, and pedipalp yellow in ethanol (Figs. 26A–C). Pedipalp measurements of male paratype in millimeters; length/width (L/W ratio): 0.34/0.12 (2.84); 0.47/0.10 (4.60); 0.28/0.11 (2.48); 0.39/0.09 (4.31); 0.31/0.09 (3.56); total length: 1.79 (Table 8).

Spermatopositor (Fig. 29G) similar to that of *H. boyacaensis*, but more elongate,

TABLE 7. LEG MEASUREMENTS OF MALE PARATYPE MCZ DNA104646: L = LENGTH, W = WIDTH, L/W = L/W RATIO.

Leg	Trochanter			Femur			Patella			Tibia			Metatarsus			Tarsus			Total
	L	W	L/W	L	W	L/W	L	W	L/W	L	W	L/W	L	W	L/W	L	W	L/W	
I	0.34	0.38	0.89	1.10	0.37	2.97	0.62	0.33	1.87	0.86	0.31	2.77	0.48	0.29	1.65	0.69	0.35	1.97	4.09
II	0.34	0.39	0.87	0.89	0.39	2.28	0.51	0.37	1.37	0.67	0.42	1.52	0.33	0.32	1.03	0.70	0.47	1.68	3.44
III	0.35	0.32	1.09	0.68	0.37	1.83	0.45	0.34	1.32	0.49	0.43	1.13	0.45	0.34	1.23	0.56	0.35	1.60	2.98
IV	0.42	0.52	0.94	0.92	0.51	1.80	0.69	0.49	1.40	0.72	0.53	1.35	0.65	0.44	1.47	0.60	0.40	1.22	3.98

with a series of four to seven dorsolateral microtrichiae on each side, shorter than the ventral plate, fringed distally by a series of very short microtrichiae, four to five on each side. Dorsal side with two largely fimbriate lobes surrounding the gonostome, much shorter than the ventral plate.

Description of Female. Total length of female paratype (in millimeters): 3.65; maximum width behind ozophores: 1.65 (L/W = 2.21); width across ozophores: 0.95; greatest width: 1.22; body light brown and legs orange in ethanol (Figs. 26D–F). Ovipositor not studied.

Distribution. Known only from the type locality in the Parque Nacional Natural Tamá, Departamento de Norte de Santander, Colombia.

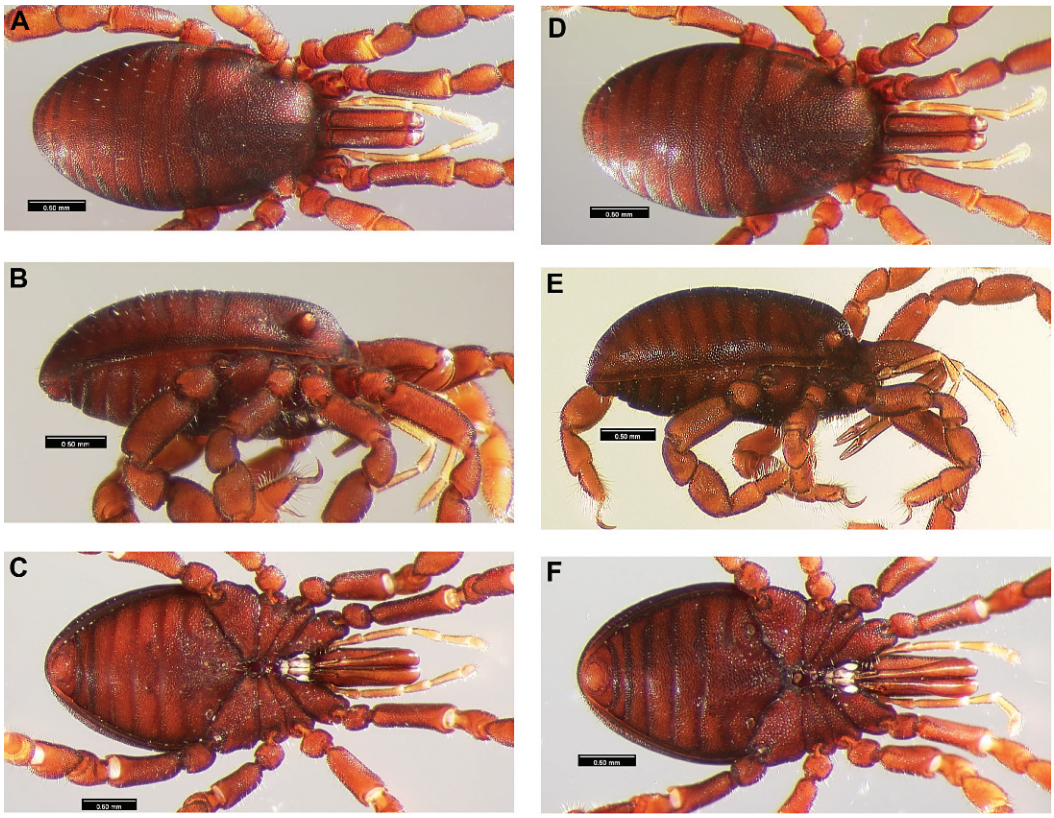

Figure 26. *Huitaca tama* new species (A–C) Holotype male (MCZ DNA101671) in dorsal (A), ventral (B), and lateral (C) view. (D–F) Paratype female (MCZ DNA101672) in dorsal (D), ventral (E), and lateral (F) view. Scale bars 500 μm.

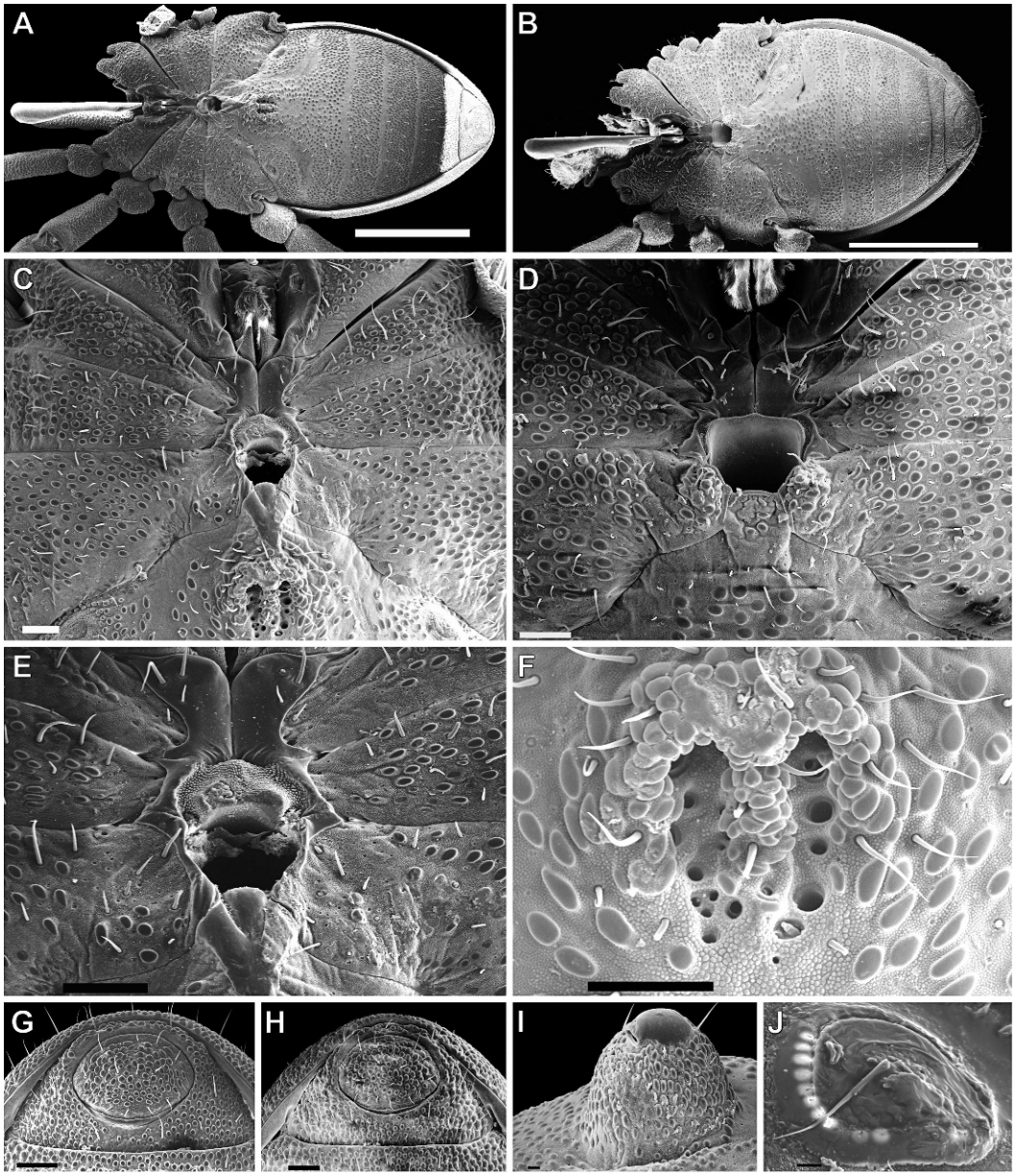

Figure 27. *Huitaca tama* new species. Paratype male and female (MCZ DNA101673). (A) Paratype male in ventral position. (B) Paratype female in ventral position. (C) Male ventral thoracic complex. (D) Female ventral thoracic complex. (E) Detail of the male gonopore. (F) Male exocrine gland. (G) Male anal plate. (H) Female anal plate. (I) Female anal plate. (J) Male ozophore. (J) Male spiracle. Paratype male and female (MCZ DNA101673). (A, B, scale bars 1 mm; C–H, scale bars 100 μm; I, J, scale bars 10 μm.)

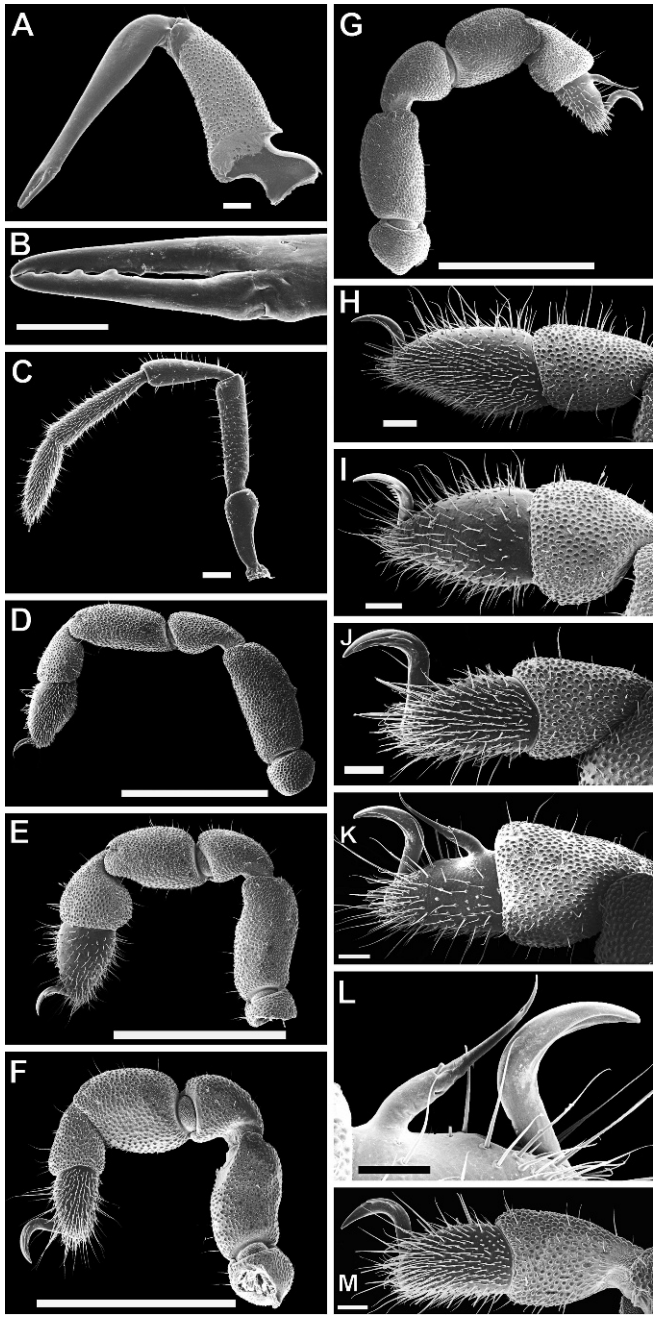

Figure 28. *Huitaca tama* new species. Paratype male and female (MCZ DNA101673). (A) Left chelicera of male. (B) Detail of the cheliceral pincer. (C) Left pedipalp of male. (D) Leg I of male. (E) Leg II of male. (F) Leg III of male. (G) Leg IV of male. (H) Metatarsus and tarsus I of male. (I) Metatarsus and tarsus II of male. (J) Metatarsus and tarsus III of male. (K) Metatarsus and tarsus IV of male. (L) Male adenostyle. (M) Metatarsus and tarsus IV of female. (A–C, H–M, scale bars 100 μm; D–G, scale bars 1 mm).

Table 8. Leg measurements of male paratype MCZ DNA101673: L = length, W = width, L/W = L/W ratio.

	Trochanter			Femur			Patella			Tibia			Metatarsus			Tarsus			
Leg	L/W	L	W	L/W	L	W	L/W	L	W	L/W	L	W	L/W	Le	W	L/W	L	W	Total
I	0.26	0.32	0.80	0.78	0.33	2.34	0.40	0.28	1.44	0.57	0.28	2.02	0.45	0.22	2.06	0.36	0.21	1.75	2.82
II	0.26	0.24	1.06	0.61	0.33	1.87	0.23	0.28	0.81	0.41	0.29	1.41	0.41	0.33	1.25	0.43	0.29	1.49	2.33
III	0.31	0.26	1.20	0.45	0.30	1.47	0.24	0.24	0.99	0.24	0.35	0.69	0.28	0.22	1.31	0.33	0.18	1.80	1.85
IV	0.34	0.32	1.04	0.67	0.37	1.80	0.32	0.33	0.98	0.43	0.40	1.08	0.45	0.38	1.19	0.38	0.23	1.69	2.58

Huitaca ventralis Shear, 1979

Figure 29H

Huitaca ventralis Shear, 1979: 240–242, figs. 1–10; Giribet & Boyer, 2002: figs. 1, 18; de Bivort & Giribet, 2004: figs. 11b, 13b, 15b, 17b, 19b, 23b, 25b, 29b, 31b, 33b, 35b, 37b, 39b; Giribet & Prieto, 2003: figs. 33, 35, 37, 39, 40; Benavides & Giribet, 2007: figs. 5–7.

Type Specimens

Holotype. Male (MCZ 14835) from 30 km south of Chinácota, 320 m, Departamento de Norte de Santander (Colombia), 14 May 1975.

Paratypes. One male (mounted on SEM stub; illustrated in de Bivort and Giribet, 2004) and one juvenile (MCZ 30323), same collecting data as the holotype.

Notes. The type specimens have been profusely illustrated with Automontage and SEM (Giribet and Boyer, 2002; Giribet and Prieto, 2003; de Bivort and Giribet, 2004; Benavides and Giribet, 2007). Here we report a new collection of this species for 8 males, 11 females (MCZ DNA101674) from Camino Real (7°25′N, 72°26′W), 2,500 m, Parque Nacional Natural Tamá,

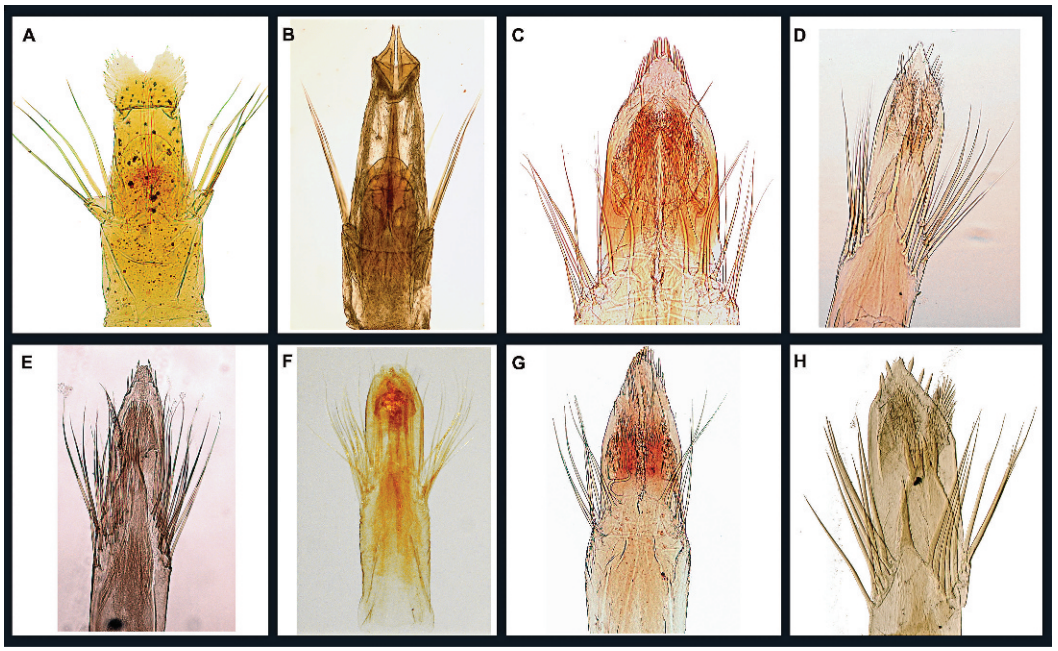

Figure 29. Dorsal view of spermatopositors of (A) *Brasilogovea chiribiqueta* new species, (B) *Neogovea hormigai* new species, (C) *Huitaca boyacaensis* new species, (D) *Huitaca caldas* new species, (E) *Huitaca depressa* new species, (F) *Huitaca sharkeyi* new species, (G) *Huitaca tama* new species, (H) *Huitaca ventralis*.

Departamento de Norte de Santander (Colombia), 30 June 1999, A. Cortés leg. These specimens were identified as "*Huitaca* sp. 6" by Benavides and Giribet (2007); six males, three female and four juveniles (MCZ DNA106856) from Quebrada Salinas (7°27′31″N, 72°50′36″W), 2,300–2,850 m, Sector Sisavita, Vereda Carrizal, Cucutilla, Departamento de Norte de Santander (Colombia), 19–22 March 2002, Winkler trap, E. González and A. Pulido leg.; two males and one female (MCZ DNA106857) from Quebrada Poveda (7°27′N, 72°50′W), Sector Sisavita, Vereda Carrizal, Cucutilla, Departamento de Norte de Santander (Colombia), 24–26 March 2002, 2,100 m, edge of forest, E. González, A. Pulido, and A. Santamaría leg.

DISCUSSION

Figure 2 shows the results from a recent phylogenetic analysis for the tropical Gondwanan family Neogoveidae (Giribet et al., 2012). An important difference with most other cyphophthalmid families—perhaps with the exception of Stylocellidae (e.g., Shear, 1993; Schwendinger and Giribet, 2005; Clouse and Giribet, 2007, 2010; Giribet et al., 2007; Clouse et al., 2009)—is the large amount of undescribed diversity. Here we described six new species for the genus *Huitaca*, formerly monotypic, and two additional Neotropical species in the genera *Neogovea* and *Brasilogovea*, the latter also previously monotypic, and only recently resurrected. Furthermore, *Metagovea* is recognized as a broadly distributed genus found from the eastern part of the Amazon rain forest to the Andes. This genus still includes loads of undescribed species, which will be dealt with in future studies after examining additional material from near Manaus (Brazil), only recently available for molecular study.

We were able to confirm the monophyly of the family Neogoveidae and of most of the Equatorial South American genera (with the exception of the genus *Canga*, which is a relict species, sister to the African clade) (Giribet et al., 2012) (Fig. 2). With respect to the internal resolution of the neogoveid genera, in a previous molecular phylogeny of the suborder Cyphophthalmi (Boyer et al., 2007), two clades were resolved: the African + Florida clade containing *Metasiro americanus* + *Parogovia* and a South American clade composed of *Metagovea* + "*Neogovea*" + *Huitaca* + the juvenile "Neogoveidae sp.," the latter now proposed as a probable member of *Brasilogovea*. However, there was a lack of resolution within the South American genera, and, as discussed above, specimens identified as *Neogovea* in that analysis (Boyer et al., 2007) in fact belong to the *Metagovea* clade. Most recent analyses recover the four recognized genera within the family, *Huitaca*, *Metagovea*, *Neogovea*, and *Parogovia*, plus the re-erected genus *Brasilogovea*. These analyses also recovered a stable relationship for the Neotropical genera with *Metasiro* as sister to all other neogoveids, and *Canga* as the sister group to the African *Parogovia*, and a diverse clade of Amazonian/Andean species with a stable structure as follows: ((*Brasilogovea*, *Neogovea*),(*Huitaca*, *Metagovea*)) (Giribet et al., 2012).

Brasilogovea is most similar to the members of the genus *Huitaca*, both with a modified sternal opisthosomal region, but males of *Brasilogovea* lack sternal pores, whereas the pores are conspicuous in *Huitaca*. This characteristic was initially thought to be an apomorphy of certain *Huitaca* specimens; our analyses clearly showed that the two genera are monophyletic and that they are not each other's sister taxa, hence justifying our taxonomic decision of keeping both genera. Instead, *Brasilogovea* appears as the sister genus of *Neogovea*, both with the typical fimbriate adenostyle, whereas *Huitaca* has a lamelliform one. It is not implausible that additional genera would be recognized after including more diversity from the eastern region of northern South America, with quite a lot of morphological disparity but for which we lack specimens for molecular examination. Likewise, what we here interpret as *Metagovea* may require

re-examination when the type species of the genus and the two other species described are examined molecularly, as the described species are all small neogoveids, whereas the clade here named *Metagovea* includes large and small species, some sympatric, but not sister pairs.

Within *Huitaca* the species that inhabit the Cordillera Occidental of Colombia (*H. bitaco*, *H. caldas*, *H. depressa*, and *H. sharkeyi*), there are two clades, *H. bitaco* and *H. sharkeyi*, constituting the sister group of the *H. ventralis* group (*H. boyacaensis*, *H. ventralis*, and *H. tama*) (Fig. 2). The species from the Cordillera Occidental are characterized morphologically by the presence of an accessory cuticular structure, probably of glandular nature, in the male leg IV and by having the metatarsus and tarsus of all legs completely ornamented, and therefore these characters may constitute the plesiomorphic condition for the genus. This ventral cuticular structure constitutes an addition to the sexually dimorphic characters for Cyphophthalmi recently reviewed by Willemart and Giribet (2010). The members of the *H. ventralis* group are much more uniform in the shape of the opisthosomal sternal organ and lack ornamentation on the tarsi of all walking legs.

The finding of ca. 40 new species of the family in South America (Benavides and Giribet, 2007) and their examination using SEM in this study have revealed new cuticular structures not discussed previously. As a result, new characters were recognized for the diagnosis of the genus *Huitaca*, most remarkably the elaborated secretory complex on the second opisthosomal sternal segment of males with accessory structures and sternal depressions. Within the family, the secretory organ is always located in the second sternite of males in almost all genera (in *Metasiro* presents an anal position; see Giribet et al., 2012), but in other genera, the gland opens with a single pore, or there is no gland, as in *Neogovea* or *Canga*; in *Huitaca* these secretory structures reach great complexity, allowing easy differentiation among the species in the genus.

The males of three species described here, *H. caldas*, *H. bitaco*, and *H. depressa*, furthermore display one feature not described previously in any neogoveid, a sternal depression between opisthosomal sternites 2 and 5 along the midline, but these resemble some of the ventral depressions associated to the presence of opisthosomal sternal glands in Troglosironidae (Sharma and Giribet, 2009b). Another feature that is observed for the first time in neogoveids are the two depressions on the margins of the female anal plate in *H. depressa*, depressions with granules of possible glandular function but so far unknown in other species.

Neogoveids still constitute a terra incognita in terms of species numbers, with their center of diversity in the tropical rain forests of South America and West Africa, two regions that include some of the most diverse but endangered terrestrial habitats (Myers et al., 2000). This study is merely a small initial step toward formalizing and describing such enormous diversity.

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